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PRACTICAL PLANTER:

CONTAINING DIRECTIONS FOR THE PLANTING OF WASTE LAND, AND MANAGEMENT OF WOOD:

WITH A NEW METHOD OF REARING THE OAK.

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WILLIAM BLACKWOOD, EDINBURGH: AND

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TO THE RIGHT HONOURABLE

THE EARL OF FIFE, VISCOUNT MACDUFF, BARON BRACO,

K. T. G. C. G. K. S. F. ETC.

THE FOLLOWING PAGES,

ON THE PROPAGATION AND MANAGEMENT OF FOREST TREES,

THE RESULT OF EXPERIENCE CHIEFLY ACQUIRED

IN HIS LORDSHIP'S SERVICE, ARE MOST

RESPECTFULLY INSCRIBED,

BY HIS MOST DEVOTED, FAITHFUL, HUMBLE SERVANT,

THO[s]. CRUICKSHANK.

ures in question could not, in every case, be occasioned either by climate or soil, as was commonly supposed; and he began to suspect that the fault lay in the mode of cultivation. In this opinion he was confirmed by what he had observed to take place in the nursery; and as soon as circumstances afforded him opportunity, he put his surmises to the proof, by certain very simple, but, as it appeared to him, decisive experiments. The result of these first led him to conceive the idea of writing a short treatise on the culture of oak, and he intended, at first, to confine his remarks to that subject only. After becoming acquainted, however, with the expensive manner in which planting in general, but especially the planting of firs, is carried on in certain districts, he thought it would be useful to give an account of the far more economical methods, which he had himself seen extensively, as well

as successfully, practised. He was led still farther to extend his plan, by finding that some of the most popular works on the subject of arboriculture inculcated principles which he could not but deem erroneous, without rejecting the testimony of some of the plainest and most certain facts that had fallen under his notice. Thus, the work gradually assumed its present form, containing remarks on the culture and management of the different kinds of wood, from the raising of the plant in the nursery, to the cutting down of the full grown tree.

In the introductory remarks, the reader will find a short view of the advantages to be derived from the cultivation of wood, and a summary of the more important errors usually committed in that department. The first chapter gives a brief account of the principal trees, whose culture is described

in the following part of the work. The subjects next treated are the nursery, saving of the seeds of trees, and purchasing of plants. A chapter on the qualities of soil most proper for the different kinds of trees, with remarks on aspect and elevation, and another on ascertaining the quality of waste land from the nature of the wild plants which grow on it, succeed. The planting of waste lands is the next subject that comes under consideration. Then the management of woods, according to the principles of the new method proposed by the author; the propagation of underwood, and remarks on raising succession crops of timber, follow in the order in which they are here mentioned. An account of Sir HENRY STEUART'S celebrated method of giving immediate effect to wood, by removing large trees, is added, as a topic which it would now be unpardonable to omit in any book on planting; and the

work closes with a sketch of the properties and applications of the different kinds of British timber.

With the exception of a few discussions, which could not well be avoided, the matter contained under these heads will be found of a strictly practical description, and, so far as it is so, (exclusive of the chapter which gives an account of Sir HENRY STEUART'S system), it is wholly the result of the author's experience. To this he has nothing to add; but that, as it is possible he may have sometimes fallen into mistakes by drawing wrong conclusions from what he has observed and seen, he has been careful to state the facts on which his opinions rest, that the reader may the more easily judge for himself.

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PLANTING, &c.

INTRODUCTORY REMARKS.

I. ADVANTAGES OF PLANTING.

From the unrivalled extent of its commerce and manufactures, as well as from its vast naval establishment, this country consumes an immense quantity of timber. The value of that article annually imported into Great Britain and Ireland, is said to amount to no less a sum than L.1,600,000 Sterling*. We have, at the same time, in Scotland, to say nothing of the other two kingdoms, upwards of twelve millions of acres of waste land, completely useless for agricultural purposes, and of extremely little value as pasturage, but of which two-thirds, at least,

* That the statement here made, (namely, that the annual import of foreign timber amounts to £1,600,000), must fall far below, instead of exceeding, the truth, the reader will be con-

are well adapted for the production of wood. By planting these extensive tracts, our home supply of timber might easily be rendered equal to our demands, and a sum which, according to the present

vinced by consulting the following table of duties paid on this article in the year 1827:—

PINE TIMBER.

Balks and ufers,	£ 1,096
Battens and batten-ends,	111,013
Clap and pipe boards,	834
Paling,	382
Deals,	634,737
Deal-ends,	32,820
Fire-wood,	2,913
Fir quarters,	3,520
Lath-wood,	35,821
Masts and spars,	21,464
Fir-logs, 8 inches square, and upwards,	575,452
	£ 1,420,052

OAK, ELM, ASH.

Handspikes,	£ 660
Knees for ships (oak),	1,262
Oak plank,	22,752
Oars (ash),	1,222
Staves (oak),	50,139
Oak logs	30,102
Wainscot logs	13,270
Unenumerated timber,	7,880
	£ 127,287

rate of wages, would maintain fifty thousand labourers and their families, or between two and three hundred thousand individuals, be retained in the country, instead of going, as at present, to add to the riches and prosperity of other nations.

It is not, however, by regarding the planting of our uncultivated moors as a means of mere pecuniary saving, that its national advantages are most conspicuous. A still clearer view of its utility, may be seen in the evils that threaten us, if our forests are not speedily improved and rendered more extensive. Their present state is such, that, were our foreign intercourse cut off, they would be completely exhausted in the course of four or five years. This would be the case, even if every sort of timber answered every purpose alike; for, of some sorts, we have not a sufficient quantity to last half that time. Our oak, for instance, would scarce stand out two years, supposing us to be, as at present, in a state of profound peace, and our navy requiring no addition to its strength. One hundred and eighty thousand cubic feet, or between four and five thousand tons of this sort, are consumed in building a ship of seventy-four guns. There are not so many full grown oak trees in Scotland, as would build two ships of this size; and the royal forests in England

are said to be in such an exhausted state, as not to be able to answer one-fortieth part of the demands made upon them.

How formidable, therefore, would be the inconveniencies which we would labour under, were a stop put, even for a short period, to our intercourse with those countries from which we import the twelve millions of cubic feet of timber, which we require annually to make up the deficiencies of our native resources. To say nothing of the shock which such an occurrence would give to our commercial shipping interests, and other civil departments, no means would be left us of keeping up our navy,—the chief bulwark of our defence. Yet there is surely no impossibility, nor even very great improbability, of our being engaged, some time or other, in war with those very states, from which our supplies of wood are, for the most part, derived.

But our foreign trade in timber must soon be attended with great difficulties, though we should for ever remain in a state of the profoundest peace with all surrounding nations. The principal sources from which we are furnished with this article at present, are Canada and the northern parts of the Continent of Europe. From the former we import an immense quantity of almost every variety of the

more useful kinds of timber. It is the supplies brought from this quarter that are the chief cause of the low rate at which wood has sold during late years. Were these supplies dried up, the price of the article would rise to a degree that would be severely felt, in every department in which it is used. And, though the forests of America are of vast extent, the parts of them which are available to us, are confined within limits comparatively narrow, and will soon be exhausted. It is only when wood is situated in the neighbourhood of navigable rivers, or near the sea-coast, that the inhabitants of Canada can derive any advantage from cutting it down for exportation. In a country where there are no roads, and where wages are high, wood cannot be brought from any considerable distance inland, but at an enormous expense. The carriage of a log thirty or forty miles overland, in such circumstances, would thrice exceed in cost its voyage of three thousand miles across the Atlantic; and the price of wood in this country would require to be more than double what it is at present, to leave any profit at all to the exporter. Now, the banks of the navigable rivers are the very situations, where colonists, for obvious reasons, prefer to settle; and, as the population increases, the woods must, by some means

or other, be cleared away. Hence, it is no uncommon thing for thousands of acres of it to be consumed by fire* in a single season, for the purpose of

* The method of burning, pursued in British America, for the purpose of clearing the land, often consumes far beyond the limits intended by those who practise it. Whether the dreadful conflagration, which took place at Miramichi in 1825, proceeded from this, or some other cause, does not seem to be well ascertained; but it furnishes a striking example of the mischief that may be done by fire among growing wood, and may be quoted as a warning against tampering with that element in the neighbourhood of plantations,—a practice to which many people in Scotland are too much addicted, on occasions of heath and furze burning. The following is an account of the above mentioned conflagration, from MACGREGOR's "Sketches of the Maritime Colonies of British America:"—

"In October 1825, upwards of a hundred miles of the country, on the north side of Miramichi river, became a scene of the most dreadful conflagration that has perhaps ever occurred in the history of the world. In Europe, we can scarcely form a conception of the fury and rapidity with which the fires rage through the American forests during a dry hot season; at which time the underwood, decayed vegetable substances, fallen branches, bark, and withered trees, are as inflammable as a total absence of moisture can render them. When these tremendous fires are once in motion, or, at least, when the flames extend over a few miles of the forest, the surrounding air becomes highly rarified, and the wind naturally increases to a hurricane. It appears that the woods had been on both sides

preparing the ground for cultivation. In the course of forty or fifty years, therefore, it may be as uncommon to import wood from the British settlements in North America, as at present it is to bring the same commodity from the United States.

It would appear, then, that the cultivation of wood at home, and the planting of our lands not appropriated to agriculture, are objects of no small importance, considered in a national view. The private advantages to be derived by the proprietors of land, from a proper attention to the same department of rural economy, may be rendered no less conspicuous.

of the north-west branch, partially on fire for some time, but not to an alarming extent, until the 7th of October, when it came on to blow furiously from the north-west, and the inhabitants on the banks of the river were suddenly alarmed by a tremendous roaring in the woods, resembling the incessant rolling of thunder; while, at the same time, the atmosphere became thickly darkened with smoke. They had scarcely time to ascertain the cause of this phenomenon, before all the surrounding woods appeared in one vast blaze, the flames ascending more than a hundred feet above the tops of the loftiest trees, and the fire, like a gulf in flames, rolling forward with inconceivable celerity. In less than an hour Douglastown and Newcastle were enveloped in one vast blaze, and many of the wretched inhabitants, unable to escape, perished in the midst of this terrible fire."

The uncultivated grounds, in this part of the country at least, are, in their present state, of extremely little value. On an average, they are not worth above a shilling per acre, as pasturage either for black cattle or sheep, nor do they yield more to their proprietors. By turning them into woodland, however, their value, taking the best of them with the worst, might be increased at least a hundred-fold. An acre of land which is dry, and in its natural state covered with thriving heath, though it have no higher marks of fertility than appear in the production of this hardy plant, will bring six hundred Scots firs or larches to such a degree of maturity in sixty years, that they will be worth, on an average, ten shillings each, or three hundred pounds Sterling in whole. This sum, divided by the age of the trees, gives a rent of five pounds annually for the land. Nothing will be to deduct from this for the expense of planting, inclosing, and management, as three or four thousand trees being at first put into the ground, those cut down from time to time, in order to reduce the plantation to the necessary thinness, will do more than return the money laid out with full interest. Supposing none of the thinnings taken out the first five and twenty years to be worth any thing, and that there are at

that time four hundred more than the number which will have room to stand till they reach their full size, and that these four hundred being cut during the next ten years, sell at sixpence each, one with another, their price will amount to ten pounds, a sum more than double what will be necessary to clear all the expenses laid out on the plantation from first to last.

The above calculation is intended for land that is neither of the best nor worst kind that we meet with in our moors, but of a medium quality; and it is designedly made so as to fall below, rather than exceed the truth. Where the soil is of a quality adapted for the more valuable kinds of timber, or even fertile enough to bring firs to their maximum size, much greater profits will be returned *. As much of this superior quality will at least be found in our waste-lands, as will make up for the deficiencies of the worst kinds of soil, and bring the average profits of planting to the above mentioned standard, the prices of timber being the same as they are at present.

But if we increase the extent of our forests, it is

* Returns will often be as high as £ 10, £ 15, and £ 20 annually.

often said, far beyond the boundaries which they now occupy, there will be a much larger supply of wood in the market than at present is the case, and the price of the article must of necessity fall. Supposing this to be true, it would still be a very weak argument, when used, as it commonly is, to dissuade from planting. Were timber reduced to one-fifth part of its present value, and gave but one instead of five pounds for the annual rent of an acre of ground, the profits of raising it on our waste lands would still be immense, if these lands in their natural state are not worth, on the whole, more than one shilling per acre annually. To suppose, however, that the price of wood will ever in this country be depressed so low, is a most absurd hypothesis. Before the extent of our full grown plantations can be increased in any considerable degree, allowing that planting should be henceforth carried on with a spirit unparalleled at any former period, fifty or sixty years must intervene. By that time our American supplies will, in all probability, have fallen off so much as to leave a void in the market, which will afford ample room for the increase of our own produce.

But there are other advantages to be derived from planting, besides the profits that arise from the sale

of the trees. It is a very common objection to the cultivation of wood, that it encroaches on the extent of our pastures, and thereby has a tendency to diminish the numbers of our cattle. Were this true, it would have no weight as an argument, as we have already proved that the waste lands of this country are infinitely more profitable when employed in raising wood than in raising live stock. Nothing, however, can be more false. For twenty or thirty years after a piece of ground is planted, indeed, cattle must be entirely excluded, as, if admitted, they would utterly destroy the young trees. But, during this period, the pasturage is undergoing a very great amelioration. As the trees grow up, the heath, which affords little nourishment, is gradually eradicated, and its place supplied by a tender natural grass, that makes excellent food for cattle. The pasturage thus becomes, at least, three times more valuable than it was before, at the same time that it has the advantage of being so well sheltered, that cattle may be turned abroad upon it much earlier in spring, and kept on it later in autumn, than the cold will permit in the open fields. In the shelter of a wood, indeed, lean stock may be sent abroad at every season of the year, without sustaining the smallest injury.

Planting may even be used as a means of preparing uncultivated land for agricultural improvement. It may seem a very paradoxical fact, but it is nevertheless true, that wood, instead of impoverishing the ground on which it is produced, enriches it. There is very little of our waste land, that, if trenched or ploughed, will carry even a moderate crop of grain, unless it receive a considerable quantity of manure. After bearing timber, however, the contrary is found to be true. Every one who has seen old woodlands brought into cultivation must be aware of this, though to others the assertion will, no doubt, appear groundless. For my own part, I have seen the fact, as it is here stated, so clearly exemplified, that I consider it to be established as firmly as experience can establish any thing. Instead, however, of detailing the particulars of any of the cases that have fallen under my own observation, in confirmation of the point, I subjoin the following instance, an account of which was furnished me by a person, on whose correctness I can depend.

On a rising ground, not far from the village of Ellon, a piece of ground, of a dry gravelly nature, which had been lately cleared of a crop of full-grown Scots firs, was trenched in a very partial and imperfect manner, the roots of the trees being scarcely

eradicated. It was then sown with oats, without receiving either lime, dung, or manure of any other description, yet the crop was so luxuriant that a great part of it lodged. The following spring the ground was again sown with the same species of grain, without receiving any enrichment, and, when harvest arrived, the crop was unequalled by that of the richest fields, in a neighbourhood which is generally considered as fertile. The experiment was tried a third time, still without manure, and the return was again considerably above an average. The soil, as has already been remarked, was dry and gravelly, and far from possessing any natural qualities that could have been the cause of such extraordinary productiveness. When planted, it had been covered with heath, and, in that state, had not been superior to those waste lands which we occasionally see improved at a vast expence, and which will produce no kind of crop till they receive a great quantity of manure.

Those who have never had an opportunity of seeing old woodlands brought into cultivation, will scarce credit what has now been advanced. That the soil should be enriched by the production of wood, when the experience of ages has proved that it is always exhausted by other crops, will seem to them

a paradox of the most extravagant kind. If such readers, however, will be at the trouble to give a little attention to the following suggestions, the fact may appear to them much less unaccountable.

Trees draw their nourishment from a much greater depth than any of the grasses, roots, or different kinds of grain raised by the agriculturist. Most of the latter derive the whole of their subsistence from the part of the soil that lies within a few inches of the surface; but the former, from the superior strength and magnitude of their roots, are enabled to penetrate much farther, and extract food from the very rock which forms the substratum of a great proportion both of our cultivated and uncultivated grounds. This, though it does not account for lands being positively enriched by wood, makes it, at the same time, far less surprising that trees should grow to a large size, and yet not exhaust the upper part of the soil in so great a degree as most of the crops cultivated by the farmer.

There is another circumstance which gives ground in wood a great advantage over that in tillage, which is, that the leaves of the trees are suffered to decay and rot where they fall, and, by this means, an annual addition is made to the depth of the vegetable mould. Now, the leaves of a tree may be

considered as bearing the same proportion to the trunk and branches, in respect of the nourishment which they require, as the straw of corn bears to the grain. But the manure which cultivated land receives is, in general, little more than the straw which grows on it, after it has served for food or litter to cattle. Ground in wood, then, actually receives, in the annual fall of the leaves, as much enrichment as the farmer bestows on his land under tillage.

Ground employed in agriculture is exposed, at almost every season of the year, to the full action of the atmosphere, and in the drought and heat of summer much of its strength is evaporated. In land covered with wood the case is entirely different; as, from the shade afforded by the leaves and branches, very little evaporation takes place. This, then, is another reason that serves, in some measure at least, to explain the seemingly paradoxical fact in question. For, that evaporation has a very powerful tendency to exhaust land, by drawing off and dissipating the more volatile part of the matter, which assists in the process of vegetation, there can be no doubt, when we consider that any kind of dung may be deprived of the greater part of its strength by being long exposed to a dry atmosphere. Nor is it

merely by preserving its own original substance, that land in wood has the advantage of cultivated ground. Whatever is extracted from the latter, in the form of vapour, falls again, when condensed, in the shape of rain or dew; but, instead of descending wholly on the same spots from whence it rose, it is, of course, diffused over the whole space which the clouds containing it may happen to cover, and woods and moors have as good a chance of receiving it, on its return to the earth, as the ground in tillage. The part of it which falls, either on the cultivated fields, or the naked wastes, may be again evaporated before it has had time to be productive of any benefit, but the portion of it which the woodlands imbibe, is retained to enrich the soil; for, the umbrage excluding the rays of the sun, there is no possibility of its being extracted a second time. Land covered with trees, therefore, while it never loses any thing, receives, with every fall of rain or of dew, a tribute from the riches of the cultivated part of the country. The advantage derived from this source is greater than will be credited by those who are not aware how much of the substances proper for vegetable nutriment, are exhaled from the land in a gaseous state, during the dry season of the year.

But the principal way in which wood becomes in-

strumental in enriching land still remains to be noticed. When trees attain a certain size, they attract multitudes of birds, which build their nests and seek shelter among the branches. The dung of these animals is the very richest kind of manure which can be applied to land, and possesses, at least, three times the strength of that commonly used in agriculture. The quantity of it produced during the long series of years which trees require to reach maturity, is, especially where large colonies of crows take up their abode, very considerable, and must have a powerful influence in improving and fertilizing the soil. Though scarce connected with our subject, it may not be improper to remark here, that, in trenching old woodlands, for the purpose of bringing them under cultivation, what was formerly the surface should still be kept uppermost, which may be done by a very simple contrivance, otherwise the part of the soil enriched in this manner will be buried too deep for the crop to reach it.

I am aware it may be objected to all this, that trees in hedge-rows about cultivated fields, are so far from enriching land, that they render it very unproductive for several feet on each side of them, as many a farmer knows by dear-bought experience.

But we must recollect, that when trees are planted in single hedge-rows, they but very imperfectly exclude the rays of the sun, and cannot prevent evaporation—that their leaves, instead of lying where they fall, are scattered in all directions—and that they allure few or no birds, either to build their nests or take up their nightly habitation among their branches. Besides, the sterility of land near hedge-rows proceeds not wholly from its exhaustion, but partly from the drip and shade of the trees, partly from the soil being rendered *boss* or hollow by the roots, and partly from the latter making it impossible to plough so deep as would be necessary *.

* I ought not to omit here to mention among the causes why ground is improved by producing wood,—*the minuteness into which its particles are divided by the roots and their fibres.* On taking up a young tree, or even a gooseberry-bush, and shaking the earth from its roots, we find the mould that falls from it as completely reduced to powder, as if it had been passed through a fine sieve. Now, the fact seems undoubted, that land is much increased in fertility, by being brought to this state. TULL, the inventor of drill husbandry, ascribed so much to pulverization, as to assert, that it answered of itself every purpose of manure. This was undoubtedly carrying a favourite idea to an extravagant length; but the common practice of agriculture clearly shows, that the fruitfulness of the soil is promoted, in no ordinary degree, by the comminution of its parts.

But, to dismiss a topic which has, perhaps, been insisted on too long, the cultivation of wood is subservient to agriculture in a way different, either from improving the pastures or enriching the soil. Considerable quantities of wood are required in farming; and when a proprietor has to build houses or offices on a farm, he will find it a great saving to have wood fit for the purpose on his own estate. To say nothing of the price of the material itself, the carriage of it, when purchased at a distance, is always inconvenient as well as expensive; and interferes with the stated work, both of men and cattle employed in agriculture, to a degree that is not only highly vexatious, but productive, at some seasons, of no inconsiderable loss. There are, besides, a number of minor uses for which wood is absolutely necessary in farming, and for these, on account of

Hence, one of the advantages of fallowing, and of exposing land, especially when of a stiff quality, to the winter frost. But, whatever improvement ground may receive from pulverization, it receives in the highest degree by bearing a crop of trees, the roots and fibres of which separate the parts in a far more perfect manner, than any art could accomplish. Those who wish to see the advantages of pulverization fully explained and demonstrated, may consult Sir HENRY STEUART'S work on giving immediate effect to wood.

tear and wear, fresh supplies of it are often required. Such, not to mention agricultural implements, are divisions between stalls for cattle, temporary inclosures, folds for sheep, foundations for corn-stacks, and those contrivances for rendering them hollow, which are of so great utility in wet or in hot harvests. These things may appear frivolous to some readers, but farmers, who must carry materials for such purposes ten or fifteen miles, as in many places they are at present under the necessity of doing, would think it no trivial convenience to have them in their immediate neighbourhood.

In those districts of the country which are remote from sea-ports, and where the peat-mosses are in an exhausted state, the cultivation of wood is of the greatest utility as a means of supplying the inhabitants with fuel. A scarcity of this indispensable article, is one of the severest privations that can be felt, and to render it cheap and plentiful, where it was formerly dear, is one of the greatest of improvements.

The planting and cultivation of wood tends, in a high degree, to beautify the country, and improve natural scenery. Persons of taste, and those who can see utility in every thing that is productive of mental pleasure, will deem this no contemptible ad-

vantage. But as other writers have nearly exhausted this topic, it is unnecessary for me to enlarge upon it, especially as this article has already swelled out far beyond the limits I at first intended it to occupy.

After all that has been said on the advantages of planting, there is one objection occasionally made against it, which some will think, or affect to think, still unanswered, namely, that it is a species of improvement from which its author can derive no benefit, as trees require longer to come to maturity than the brief space usually allotted to human life. Many, however, have lived till the trees which they have themselves planted, were fit for most of the purposes to which timber is applicable; and every one who plants before he is fifty years old, may reasonably hope to see his plantations in a state of such advancement, as to be not only in the highest degree ornamental to his estate, but as likewise to promise that his immediate successor may derive from them no small accession to his income. Planting may, in fact, be considered as one of the surest methods by which a proprietor of land can enrich his descendants, and increase the opulence of his family in future years. To those, indeed, who are so concentrated in self as to be wholly indifferent abou

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the interests of posterity, this argument will have no weight; but it is to be hoped that such persons are extremely few in number, and that it would be scarce worth while to attempt converting them to more liberal sentiments, supposing it possible.

II. ERRORS GENERALLY COMMITTED IN THE CULTIVATION OF WOOD.

FREQUENT opportunities will occur of pointing out what seems to be erroneous in the common methods of cultivating wood, as we proceed with the work. It may not, however, be improper to give a kind of synopsis, or connected view of the more important errors with which these methods are chargeable, as part of our introductory matter, that they may the more prominently meet the attention of the reader.

One of the most fatal of these errors is, when we plant without being sufficiently careful to adapt the trees to the soil, or, in other words, when we do not studiously enough select such species as the land is best qualified to bring to perfection. This mistake is perhaps more general than any other, and has been the source of much loss and disappointment. Nothing is more common than to see trees, which

timber, is a wrong or defective mode of cultivation. As many planters seem to be of opinion that every kind of soil is equally adequate for the production of every kind of trees, so they appear to think the same culture is equally appropriate for all. Hence the most different species are often treated in precisely the same manner, no allowance at all being made for the peculiarities of constitution which nature has assigned to each. If a fir thrives with a certain mode of treatment, it is inferred as a matter of course, that an ash, an elm, or any other variety, will succeed as well under similar management; nor is the culture generally blamed, when the event proves contrary to what had been anticipated. Firs are found to succeed well when they are removed from the nursery to their final destination, at two years of age; and in districts where they have been nearly exclusively cultivated, if at any time it happen that a few deciduous trees, of the more valuable kinds, be planted, they are sure to be taken from the ground where they have been raised from the seed, at the same age, without inquiry being once made, whether such usage be consistent, or inconsistent, with the nature of the plants. In places, on the contrary, where deciduous trees have been

most cultivated, and where long experience has taught that the greater part of them ought to remain at least four or five years in the nursery, it is customary to treat firs in a manner precisely similar, without taking into consideration any of the circumstances in which these sorts differ from one another. A still more striking example of improper culture exists in the common method of treating the oak,—a method which has made that tree one of the rarest productions of our forests.

Planting is often carried on in a much more expensive plan than is in any degree necessary. It is frequently executed in England, and even in the south of Scotland, at as high a rate as from six to twelve pounds per acre. This arises partly from expending much useless labour in preparing the ground, partly from making use of plants of too large a size, and partly from the adoption of improper methods of putting them into the ground. By following the plan recommended in the succeeding part of this work, firs, and all the tribes that can be removed from the nursery, when they are two years old, may be planted as low as eighteen shillings per acre, or even lower; while those species that require to be of a greater size and age, before they can be transported to their final destination, may

be propagated to any extent, at an expense of from one to two pounds per acre, exclusive of enclosing the ground.

The pruning and thinning of wood are often, especially in the northern counties, sadly neglected. This is an error of no small importance, as it may cause a plantation to be worth less than half what it might have been under different management. Bad, however, as is the total omission of these operations, it is far from being so pernicious as the performance of them on wrong principles, which too frequently happens. Not to prune or thin a wood, when either is requisite, is like leaving a sick person without medical aid; but to apply these processes in an erroneous manner, is to prescribe such nostrums to the patient as will serve only to aggravate his disease.

Considerable mischief has been done of late years to the interests of arboriculture in Scotland, by a too close attention having been paid to the maxims of certain English writers, or of persons to whatever part of the island they originally belong, whose practical knowledge has been gathered, for the most part, south of the Tweed. It is not to be denied, indeed, that some of them have given us many useful hints with regard to the management of the trees

most commonly cultivated in England, such as the elm, beech, sycamore, and, in general, all the hard wooded kinds, to the rearing of which much greater attention is there paid than has ever been done in Scotland. But with regard to the culture of firs, these writers have fallen into gross mistakes, which, perhaps, is what might be expected from the comparatively few opportunities which most parts of England afford for becoming acquainted with the nature of this class of trees. We accordingly find some of those who have spoken most sensibly with regard to the management of every other kind of tree, gravely recommending that firs be pruned, and enforcing the direction in the strongest terms that can be applied to such a purpose. A maxim more pregnant with ruin to our fir plantations than this, supposing it generally acted upon, could hardly be expressed in words. Yet it has already been put in practice in too many instances, even in this country, where pruning is so often neglected in cases where it is really necessary. That the mischief has not spread further than it has yet done, we have, perhaps, to thank that unwillingness to lay out any expense on plantations, which is so prevalent in Scotland; and we have thus another exemplification of the adage—" That there is no evil which is not

productive of some good." Many of the writers in question seem not even to know what kind of soil is most proper for the various sorts of trees. One of the most respectable of them, PONTEY, tells us that the spruce will thrive well in dry land, meaning, that it will attain a large size in such a situation,—an assertion which will not be found correct in one out of ten thousand cases. To every general rule there are some exceptions, and a tall spruce may be occasionally found in very dry ground, as a pretty large Scots fir will sometimes occur in a marsh. Some anomalous case of this kind it may have been that has deceived Mr PONTEY, or, more probably, he has been imposed on, by having seen in land of the quality he describes, some plantation or other of spruce, below twenty years of age, which had a thriving look; for, till near that period, the tree will seem to flourish in the very driest soils; but its lower branches will then begin to decay, its growth will be arrested, and its appearance, in the course of a few years, will be such as effectually to dissipate every hope of its ever attaining the size of useful timber. When such mistaken notions as these appear in works which are widely circulated, they cannot fail to mislead, and prove highly mischievous.

Even the raising of firs from seed in the nursery,

seems to be but very imperfectly understood in the southern part of the island. In LOUDON'S Encyclopædia of Gardening,—a work which contains a vast mass of general information on the subjects of which it treats, as well as many useful practical directions, we are told that the seeds of the spruce, larch, and Scots fir, should be covered half an inch deep. If this be the general practice in England, it serves, in some measure, to explain, why so many seedling firs are imported annually into that country, from a latitude so far north as Aberdeen *, where a

* Some apology may perhaps be requisite for so often quoting examples from *Aberdeen* and *Aberdeenshire*, as is done in the following pages, as there may be some people in the south, who are of opinion, that little can be learned respecting the culture of trees from that quarter. I may state, therefore, (and the fact is mentioned, I believe, in LOUDON'S "Encyclopædia of Gardening," article *Aberdeenshire*), that planting has been carried on here to a greater extent, during the last thirty years, than in any other district of equal size in Great Britain. It is farther to be noted, that the finest pine forests now remaining in the island, are those belonging to the EARLS of FIFE and ABOYNE, in that county; and, that the cheapest and most successful method of planting firs ever known, originated in Aberdeenshire. With regard to the culture of hard wood, I claim no pre-eminence for the Aberdonians; on the contrary, I am willing to allow, that, in this department, they are rather behind some of their neighbours.

As

depth of a quarter of an inch of light earth is deemed an amply sufficient covering for the seeds of any of the above mentioned species. A fir, in coming up, is among the weakest of plants, and to put the seed deeper in the earth than is barely necessary to make it germinate, is a sure way to prevent its offspring from ever seeing the light; especially, if the ground has the least tendency to bind or grow hard. The seeds of every kind of trees, indeed, ought to be covered much less sparingly, in proportion to their size, than those of kitchen vegetables; though in sowing the former, the practice of the kitchen garden is often absurdly adopted.

In giving directions for laying out a nursery, LOUDON recommends that earth should be *forced* *,

As to the Aberdeen nurseries, they are now rather less extensive than they formerly were, owing to considerable opposition having started up of late years in the neighbourhood of towns still farther north; but they maintain their character as to the hardiness and general excellence of the plants they produce.

* I have here given the sense of Mr LOUDON's words in the technical language used among gardeners in Scotland. When mould is brought from a distance, to improve or alter the character of the soil of any piece of ground, this is called *forcing of earth*. I know of no case in which this practice is necessary in

as it is termed, in order to obtain soil exactly to suit every species of trees that it may be necessary to raise. This is another English nostrum, the chief use of which seems to be to create expense, a characteristic which, it is hoped, will ever keep it from being much admired in this frugal land. To adapt the plants to the quality of the land, when we are placing them where they are intended finally to remain, is indeed a matter of very great importance, and, without paying due attention to it, we need not expect fine timber. But any kind of trees may be easily brought to the greatest size to which it is necessary to bring them in the nursery, although the soil be not precisely of that quality

converting corn land of ordinary quality into a nursery, excepting when it happens to be too stiff for raising seedling firs. Then, and then only, it may be necessary to bring a mixture of more friable mould from some other quarter. But scrupulously to form the soil so as to be in exact accordance with the nature of every plant, that it may be necessary to raise in it, is, in the first place, to discourage the propagation of trees, by encreasing the expense; and, secondly, to transgress against that fundamental rule in arboriculture, namely, that young trees should be brought up in nursery as hardy as possible. To *force earth*, will be found, in general, equivalent to forcing the plants, for the advocates of the practice always mean to enrich, not to reduce, the soil by means of it.

which is most congenial to their nature, and it does not therefore appear that any very great advantage can be gained by preparing ground for this purpose, in the elaborate way above mentioned. In the north here, we find no difficulty in raising all the kinds of trees which are naturalized in Great Britain, till they are of a sufficient size to be transported to the moors, in land where the surface is not more than nine or ten inches distant from a subsoil of gravelly sand, and our plants are such as not to be despised even in the English market, to which no inconsiderable quantities of them are annually exported.

This freedom with the sentiments of other writers, proceeds not from any pleasure which the author has in criticising and finding fault, but from a firm conviction, that what he blames is really erroneous, and of a pernicious tendency. He wishes not to depreciate the merits of any of the popular works that have of late years made their appearance on the same subject, on which he now ventures to give his opinion, as he is convinced that, on many points, most of them may be consulted with advantage. But he conceives it to be the duty of every one, who undertakes to write on a practical subject, to point

out the errors of his predecessors, in so far as he has experience on his side. Were this not allowable, indeed, no end at all can be answered by writing on a topic which has been previously handled by others. But it is time to draw these preliminary remarks to a conclusion, and proceed to other topics.

CHAPTER I.

BRIEF ACCOUNT OF THE VARIOUS KINDS OF TREES, WHOSE CULTURE IS DESCRIBED IN THIS WORK.

SCOTS FIR.

ONE of the trees most commonly to be met with in Scotland, is that species of Pinus which takes its name from the country, viz. the Scots Fir *. This tree is a native of the British Islands, to which it is common with all the Northern Regions of Europe and Asia, being one of those plants which will grow in almost any degree of cold, short of perpetual snow. On soils of a fertile character it is short lived, but on more barren land, such as we find in mountainous districts, it attains an age of at least two centuries. The excellence of its timber is in proportion to the slowness of its growth, and to its age; it being always found of inferior quality, when produced on rich land, or when cut before it is fifty or sixty years old.

Till very lately, there was considered to be only one variety of the Scots fir, but an opinion has re-

* *Pinus scotica* of Thouin; *P. sylvestris* of Linnæus.

cently been propagated, that there are, in Scotland, two distinct varieties, at least, of this tree, one the produce of our ancient natural forests, now to be found only in the Highlands; and another, an alleged intruder from Canada, of a very inferior description, and at present exclusively cultivated in the Lowland districts of the country. Notwithstanding the high authority from which this opinion originally comes, (it having been first broached in an able treatise on Planting, in the Quarterly Review, which treatise has been universally ascribed to Sir Walter Scott), I cannot help stating doubts as to the conclusiveness of the arguments brought in support of it.

In the first place, Pursh, the author of the American Flora, and all other botanists, deny that the *Pinus sylvestris*, or our Scots fir, exists in Canada, or in any part of America. That it does so, seems therefore entirely a gratuitous assumption.

In the second place, and waving this formidable objection, it is affirmed that this Canadian variety was introduced so late as half a century ago. Now, granting that the tree which we now cultivate in the Lowlands, under the name of the Scots fir, did originally come from that part of the world, there seem to be insuperable difficulties in the supposition that its introduction was so recent. Either

the true kind must still be very common in that part of the country where it is alleged to be extinct, or seed of the spurious kind must have been regularly imported till a very late date. For it is plain, that, until the trees that grew from the cargo first imported began to bear cones, all the Scots fir-seed sown in the nurseries must have been received from the same quarter. For the first sixteen or twenty years of the half century, therefore, our nurserymen must have been in the practice of commissioning *all* their Scots fir-seed from Canada, and a *considerable* quantity of it, for at least ten years later; for many more than the first year's plantations of the spurious breed, must have been in a seed-bearing state before a sufficient home supply of the article could be obtained. It follows from this, that many of our nurserymen now living must have been acquainted with this practice at the time it was common, and must now remember it. But though I have had intercourse with many very intelligent individuals in that line, and some of them of more than thirty years standing, I could never discover that any of them had so much as heard of such a practice in their own days, or in those of their predecessors of the same profession. This misnamed Scots fir, therefore, must either have been introduced at a much

earlier period than half a century ago, or there must still be plantations of the true variety, in every district of Scotland. Now, there is considerable difficulty in believing the former part of the dilemma, because at a period when there was no great taste for planting, it is rather improbable that any Scotsman would have been at the pains of fetching across the Atlantic the seed of a tree so like one that grew every where in his own country, that he felt himself under the necessity of calling it by the same name, not to mention, that, if we make the date of introduction much earlier than fifty years ago, an improbability likewise arises from the little intercourse we had with Canada, before it belonged to Great Britain. If, on the other hand, the second part of the proposition is acquiesced in, it is as good as allowing that we have but one sort of the tree, from whatever part of the world seed of it may have been brought;—for that our plantations formed by art are all of the same kind, who ever doubted, or can doubt?

It is farther asserted that the Highland fir, which is the true species, presents a quite different aspect from this foreign variety; that it is a far nobler tree, growing with a large spreading top, and putting forth gigantic branches, and that the quality

of its timber, as well as the colour and the length of its leaves or spines, are materially different from the same characteristics in the intruder. As to the alleged disparity in the top and branches, it is easily accounted for, supposing the Highland and the Lowland firs to be members of the same native family, and lineally descended from one original stock, without foreign mixture or adulteration. In natural forests, the trees generally stand at much greater distances from one another than in plantations formed by art. That the former, therefore, should have more spreading and larger branches, is just the result of this very circumstance; for these characteristics in individuals of the same species will, other things being equal, be always found in exact proportion to the quantity of air and light admitted to each. When a Scots fir, even of this alleged foreign species, is planted in a single row, or by itself, it never fails to have both large branches and a spreading top, in comparison of what it possesses when it grows in a thicket; and the same is often the case on the outside of a large plantation, where, in one direction at least, there is no exclusion either of light or air. That the greater poverty of soil, in the districts where our natural forests are to be found, will fully account for the

superiority of their timber, to that which grows in the comparatively rich land of the lower parts of the country, any one will allow, who has ever had the opportunity of comparing the qualities of fir-wood which has grown in two different spots, the one poorer, the other richer, in relation to one another. As for the difference in the colour of the spines, which are said to be of a lighter hue in the natural than in the planted fir, it seems to admit of explanation, from what is often seen to take place in the nursery. Of two plots sown from the same parcel of seed, the plants of the one will have a yellowish tinge, while those of the other are of the deepest green; and a difference either in the soil or in the quantity of manure, is found sufficient to cause the discrepancy. As to the disparity in length of the spines, dissimilarity in exposure to the light and air may perhaps account for it.

I may have omitted some of the characteristics in which the planted and natural trees are said by the author of the essay in question, to differ from one another, as I write from memory, having neglected to take any notes when I read it more than twelve months ago; and I wish the reader to take notice that the remarks I have now made are rather the offspring of my doubt than conviction, my ob-

ject in stating them being merely to draw his attention to a question, the speedy determination of which is of very considerable importance. If it be true that the fir we now generally cultivate is in reality of a spurious and inferior breed, whether originating in Canada or at home, no time should be lost in exterminating it from our nurseries *.

THE LARCH.

The tree most generally found in our fir-plantations, next to the Scots fir, is the Larch. Unlike the rest of its tribe with which we are familiar, this tree casts all its leaves every winter. These are of a beautiful light green, and give the tree a very lively appearance, especially when in contrast with the darker and somewhat melancholy hue of the Scots fir. The blossoms are of a fine purple tint, and appear early in spring. The figure of the larch is tapering, and has something of the formality which belongs more or less to all the pine tribe. It was

* So long ago as 1811, the late eminent Mr George Don of Forfar pointed out the great superiority of a particular variety of the Scots-fir, which he distinguished by the name of *horizontal* variety, from the disposition of its branches.—*Memoirs of Caled. Hort. Soc.* voi. i. p. 124.

first imported into Britain not quite two centuries ago, from some of the mountainous districts in Italy, where it is very plentiful. It is said also to abound in many of the southern parts of Russia. The first larches known in Scotland were a couple of seedling plants sent from London by the Duke of Atholl in 1727, and for some time kept in a greenhouse at Dunkeld. One of these original larches, now an enormous tree, still remains in the pleasure-grounds there, close by the ducal palace, and may be regarded as the progenitor of all the larches in North Britain.

Among the Tyrolese and Dalmatian Alps, as we are told, the larch grows to a stupendous height. There are said to be beams of it, in some of the houses in Venice, 120 feet long. The trees from which these were cut must have been at least 140 feet high. In many plantations in Perthshire larches are to be found of 100 feet in height, and of proportionable girth. The larch is a very quick grower, and the timber of it is good, though cut young. When planted on very rich soil, the heart of the tree on being cut is sometimes found hollow. Of this I have seen several examples. There is but one sort cultivated in our plantations.

THE SPRUCE.

The Spruce is not originally a native of Great Britain more than the larch, nor does it appear to have been earlier introduced than the last mentioned tree. The species called the Common Spruce is said to be of Norwegian origin, and in its native country it rises to an amazing height. Here it is not often found above fifty feet high. Being an evergreen, it has a very pleasing effect in winter, so long as its lower branches remain unwithered. There are several American species, as the White, and the Black, so named from the colour of their bark, and the Hemlock Spruce. The two first are pretty common in our nurseries, and seem to thrive in the same kind of land as the Norwegian or Common Spruce. It is this last species that the reader is to understand as chiefly intended, as often as the Spruce is mentioned throughout the work.

THE SILVER FIR.

The Silver Fir is less common than the spruce. It is likewise a foreigner, and it is believed was first brought to this country from the Levant, or the south of Europe. If it comes from the Levant, it must grow there on high mountains, for it is as

hardy as the spruce; though, from its having been first cultivated in gardens as an ornamental evergreen, it is often described as being of a delicate constitution. It is a beautiful tree, especially when young. It receives its name from two stripes of a silvery tint on the lower side of its dark-green leaves.

BALM OF GILEAD.

The Balm of Gilead Fir is an American. Its leaves are of a yellowish-green, and its buds have an agreeable scent,—whence its name. It is not of great account as a timber tree.

Besides the kinds already enumerated, the following have been recently introduced into our forests: the Pinaster, the Stone-pine, the Siberian stone-pine, the Cedar of Lebanon, the Weymouth pine, and the Corsica pine.

THE OAK.

Of the Quercus, there are said to be nearly fifty species, some of which are deciduous, and some evergreen. It is the common or British oak only, the noblest tree of the forest, that is spoken of in this volume, which, as every one knows, is a deci-

duous tree, and an original native of our island. It is the longest lived, the most robust, and, when it rises to its natural size, the most majestic in aspect of all our trees. There is said, however, to be a counterfeit of it in the country, against which planters should, if possible, be on their guard.

"We have here to notice," says a writer in the Quarterly Review, "a fact long known to botanists, but of which our planters and purveyors of timber appear to have had no suspicion—that there are two distinct species of the oak in England, the *Quercus Robur* and the *Quercus sessiliflora*; the former of which affords a close-grained, firm, solid timber, rarely subject to rot; the other more loose and sappy, very liable to rot, and not half so durable." "This second species is supposed to have been introduced some two or three ages ago from the Continent, where the oaks are chiefly of this latter species, especially in the German forests, the timber of which is known to be very worthless. But, what is of more importance to us is, that, *de facto*, the impostor abounds, and is propagated vigorously in the New Forest, and other parts of Hampshire; in Norfolk, and in the northern counties, and about London; and there is but too much reason to believe, that the numerous complaints that were

heard about our ships being infested with what was called improperly enough *dry rot*, were owing to the introduction of this species of oak to the naval dock-yards, where, we understand, the distinction was not even suspected. It may thus be discriminated from the true old English oak: The acorn stalks of the the *Robur* are *long*, and the leaves *short*, whereas the *sessiliflora* has the stalks *short*, and the leaves *long*; the acorns of the former grow singly, or seldom two on the same footstalk; those of the latter in clusters of two or three, close to the stem of the branch."

THE ASH.

The Ash is among the most beautiful of our trees. It is either a native, or completely naturalized, and is familiar to every one. There are said to be nearly forty species of Fraxinus, but we have to do only with the common ash, *F. excelsior*. Among the peculiarities of this tree are the following:—The younger it is cut down, the richer the soil in which it is planted, and the quicker it grows, the more valuable is its timber. The age to which it will live is not well ascertained; but it occurs in many places in Scotland as old as a

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century and a half, without showing any vestiges of decay.

THE ELM.

The Elm is another tree indigenous to Britain. Fifteen species of *Ulmus* are enumerated, but those most generally known are the broad-leaved Wych-Elm, or Scotch Elm, and the English or Small-Leaved Elm. The elm is among the most majestic, as well as the longest lived, of our trees. It has a spreading top, and, when it grows to its natural size, has a very grand appearance; but, when a small tree, it has nothing particularly attractive in its look. The elm is a quick grower.

THE PLANE.

The Plane belongs to the *Acer* or Maple genus, of which there are many species. The species more particularly intended in the present volume is the Scots Plane-tree, or English Sycamore. Bating a degree of stiffness in its branches, it is, perhaps, the most beautiful deciduous tree we possess. It grows quickly on a favourable soil, and attains a great age and size. It is a native of the Continent of Europe, but whether it belonged originally to Britain is doubted by Sir James Edward Smith.

THE BEECH.

The Beech is another very beautiful tree, and, in favourable soils, attains a great height and thickness. It has been known in Britain for ages, but whether indigenous or not has been disputed. Certainly it is not a *Scottish* native. The Beech is rather inferior to the ash, elm, and plane, in quickness of growth, and it does not grow in quite so high a degree of cold as the oak. The beech, ash, elm, and plane, may be considered as belonging to the same climate, in respect of the temperature necessary for their growth.

Belonging to the same genus, *Fagus*, is

THE CHESNUT.

The Sweet or Spanish Chesnut is a fine tree, and next to the oak as to the value of its timber; but our climate is very nearly the utmost limit to which it penetrates northward, though trees of it, of a very large size, are to be found in England, and even in Scotland, where the soil happens to be very good, and well sheltered. Many writers injudiciously recom-

mend the planting of this tree to a greater extent than is justified by common sense. It is less hardy than the oak, while it does not afford better timber; and it requires richer soil, at the same time that it does not, in general, at least with us, attain a larger size. What advantage, then, saving that of variety alone, can be derived from its culture, which may not in a higher degree be derived from the cultivation of the oak? The chesnut is common to the south of Europe with the temperate parts of Asia.

What is called the HORSE-CHESNUT belongs to a very different genus, *Æsculus*. It is chiefly cultivated as an ornamental tree, its timber being of a very worthless kind. The horse-chesnut has a fine spreading top, and grows to a large size. In summer, and more especially when in blossom, no tree is more beautiful. In winter it has rather a mortified look. The horse-chesnut is hardy, and is said to have been originally brought into Europe from the north of Asia.

THE LIME.

The Lime-tree attains a gigantic size on favourable soil. It is scarcely less ornamental than the horse-chesnut, and though it has not so spreading a

top as the last mentioned tree, it grows to a loftier stature. There are several varieties of it, and the broad-leaved and the small-leaved are ranked as distinct species by Sir J. E. SMITH; but that called the *Common Lime* is the best. It is a hardy plant.

THE BIRCH.

Of the Birch there are two sorts commonly cultivated in this country, the common and the weeping birch; both of them, but more especially the latter, being very handsome trees, though they do not possess the grandeur belonging to some others. The birch is a native of Scotland, and of all the northern parts of Europe, Asia, and America. It is a very hardy tree, and attends the Scots fir in its nearest approaches to the pole.

THE ALDER.

The Alder is likewise a native of Scotland, and extremely hardy. It is generally a diminutive, ill-looking tree, but as it will grow on land which almost every other species rejects, it deserves indulgence. From the colour of the wood, it has been nick-named "*Scotch Mahogany*," an appellation which, in the

mouth of an Englishman, would sound very like an ironical reflection on the soil of our country, as if it were incapable of producing any thing better of the tree kind than this base plant of the bogs. The alder is likewise indigenous to England and all other northern countries.

THE WILLOW AND POPLAR.

Of the Willow tribe there are many species. In Scotland, we have the sweet-bay leaved, with a broad shining leaf, having an agreeable scent, and the sallow, with woolly leaves and greyish bark, commonly called "The Saugh." The wood of the former kind, which is a slow grower, is the most valuable of any of the species. There is a very beautiful species, called the Yellow or Golden Willow, which, in good soil, becomes an elegant tree. The white-leaved willow is likewise very handsome, and exceeds every other tree we possess in quickness of growth. The Bedford willow and the crack willow also grow to a large size.

The most valuable kinds of POPLAR are the Black; the Lombardy, which is often termed the White;

and that more properly called the White, which is likewise known by the name of the Silver Poplar. These are all from the Continent, or from America. The Aspen, or Trembling Poplar, is a native.

HAZEL, HAWTHORN, HOLLY, &c.

Besides the kinds of trees already mentioned, we will have occasion, in speaking of underwood, to mention the Hazel, the Hawthorn, the Holly, and several other plants, which partake nearly as much of the character of shrubs as of trees. These are all natives, and, of course, very hardy.

Of the trees now enumerated the lime is propagated by layers; the willows and poplars are propagated by cuttings, with the exception of the silver or white species, which is commonly increased by the same means as the lime; all the rest generally by seeds.

For land which, in its natural state, produces little besides heath, the proper species are the various firs, the birch, and the oak. The ash, elm, &c. require a richer soil.

CHAPTER II.

THE NURSERY—SAVING THE SEEDS OF TREES.

As those who plant on an extensive scale may sometimes find it convenient to raise their plants themselves, or part of them, it becomes necessary, in a work like the present, to give some practical directions for the laying out and management of a nursery, so far, at least, as regards the raising from the seed of the *more common* and *useful* species of forest trees. With such directions, therefore, this chapter shall be occupied.

As, in general, trees have ultimately to grow in land of a very rugged description, one great object of the nurseryman should be to bring up the young plants as hardy as possible. In making choice of a situation for a nursery, therefore, a very rich soil, and close shelter, ought by all means to be avoided.

We see the reverse of this rule exemplified in too many of our public nursery-grounds, where the plants are forced, by richness of soil and warmth, as in a hot-bed, and thereby acquire a delicacy of constitution which renders them very unfit for the bleak moorlands, where the future destiny of most of them is cast. We must, however, be on our guard against falling into the opposite error. The top or brow of a high eminence, for example, liable to run dry in summer, and exposed to the unmitigated violence of every wind that blows, would be as improper for the purpose as the richest and most sheltered situation. In the latter, the plants would grow too delicate; and in the former, it would be nearly impossible to rear seedlings at all. Some kinds of trees there are, indeed, which, when once they have acquired roots, will grow almost on solid rock, as well as in places much more elevated, than any in which it would be possible to raise agricultural produce. But, in raising plants from the seed, we must bear in mind that the roots are to be acquired, a process which does not succeed well, where the situation is lofty, or the land either extremely hard or poor. A nursery, therefore, though the artificial shelter of walls and hedges should be avoided, ought not to be on very elevated ground; and though the

soil ought not to be one of exuberant fertility, it should not, on the other hand, deserve the epithet of barren. The land which I would deem best adapted for the purpose, is that which, when properly cultivated, and, in the general run of seasons, is capable of producing what is termed an average, or a middling crop of corn. This, indeed, is superior to what we see commonly allotted to the growth of wood, and it may perhaps be said is too good for a nursery; as, if possible, we ought to remove plants from worse to better, rather than from better to worse ground. But however just such a sentiment may be in theory, we will not find it easy to reduce it to practice. Seedlings of the fir tribes, as well as of several other species, must attain a certain size, in order to enable them to stand the winter. When extremely small, they are liable to be drawn up by the frost, and rendered completely useless; and this will always be the case in soils of a very inferior nature. The evil here mentioned may, indeed, be avoided, by covering the beds with straw, or some similar substance; but all artifices of this kind are attended with more or less damage to the plants, which can never be entirely preserved from injury, unless they are themselves of a size to keep their ground independently of foreign assistance. In

very thin soils, too, the drought in summer is no less hostile than the frost in winter, causing the plants to go off in thousands soon after they make their appearance.

But it may be said, "were these remarks correct, it would follow that we would have no natural wood. The seeds that are scattered on the barren moors might germinate, but the plants arising from them would inevitably perish, instead of growing up into majestic trees, as we know actually to be the case." The answer to this is easy: A plant springing up in a moor is far from being in the same circumstances with a seedling in the nursery. The former, in the heath that surrounds it, has shelter from the wind as well as from the drought and frost; while the latter is exposed by turns to the full rigour of all the three. Besides, notwithstanding the advantages plants rising from the seed among heath, have over those in the nursery, we are certain that a great number of them, perhaps ninety-nine hundredths of the whole, do nevertheless go back; so that the fact upon which the objection is founded can never lead to the conclusion, that it is practicable to raise seedlings advantageously in ground no better in quality than the generality of our waste lands. If only *one hundredth part* of

the plants could be saved, the expense of a nursery would soon put an end to planting altogether.

I have said above, that the land which I deem best calculated for the purpose of a nursery, is that which, when properly cultivated, and, in the general run of seasons, is capable of producing an average crop of corn. This, however, is a very general description, serving merely to point out the degree of fertility which I think nursery ground should neither greatly exceed nor fall below, and may be applied with equal propriety to several specific varieties of soil, as clay, loam and others; each of which may be capable, and no more than capable, of producing an average crop of corn of some kind or other. All these varieties are not, however, equally suitable for our purpose. The proper soil for a nursery is a light one. Each species of trees, indeed, has some particular kind of soil, which it prefers to others; and, in planting waste land, this fact should be attentively regarded. But, in the nursery, where many different kinds of plants are to be raised, it is impossible to put each into the soil which they like best; because, in the extent of a few roods or less, we do not generally find varieties. There are, however, some sorts of trees, which, when they are young especially, will grow more readily

in land differing in quality from that which they naturally prefer, than others. Elm, for instance, prefers a strong clay soil; and it is perhaps impossible to bring this tree to the utmost size which it is capable of attaining, in land of a different quality; yet seedling elms may be raised without difficulty in ground of the lightest nature; and if transplanted in the same, though their growth may be somewhat slower than it would be in other circumstances, the additional time which they will require to arrive at the stature which it may be necessary they should acquire, before being removed to their final destination, will not be very considerable. The same is true of a number of other species. But seedling firs cannot be raised with eminent success, excepting in land of a pretty light quality. If the surface is apt to bind, many of the plants will never be able to pierce it; and thousands of those that do, will go off almost as soon as they make their appearance. It may be laid down as a general rule, that plants which naturally prefer a tenacious soil may be cultivated with more success in a light one, than those which prefer the latter can be in the former. Hence, in selecting a spot for a nursery, if we cannot find one containing all the varieties of land best adapted for each kind of plants we intend to raise,—and this can seldom be found,—our choice ought to

fall on one adapted for firs, as the nearest approximation we can make towards suiting all descriptions.

It is hardly possible to raise a full crop of seedling spruce, birch or alder, in land of that degree of dryness which is most proper for the Scotch fir and the larch. If possible, therefore, the nursery should contain a portion of moist land, meaning by this term, not that degree of wetness which consists in swampiness, or in the water appearing above the surface even in winter, but what is generally understood by the epithet *damp*. But, if no single piece of ground, of the requisite extent, and possessing this qualification, can be found, we have no other alternative but either to content ourselves with the more slender crops of the above mentioned species, which may be raised without it, or have two separate nurseries, the one calculated for plants which prefer a moist soil, and the other for those of a different nature. This expedient, notwithstanding its inconvenience, professional nurserymen sometimes find it advantageous to adopt.

A proper situation, or situations, being made choice of, the next work will be to prepare the ground for its intended purpose. The labour of this operation will depend on the previous state of the land. If it contain many perennial weeds, such as

couch-grass, crowfoot, wild sorrel, or others equally noxious, they must be completely eradicated, else it will be in vain to think of raising seedlings of any kind. The best method of cleaning ground in this condition, will be to trench and green crop it. The trenching should not go deeper than to the subsoil; and, in performing it, every stone larger than a common hen's egg should be picked out and carried away. The weeds, instead of being buried, should be carefully rooted up by the workmen, as they proceed, and thrown upon the surface to dry, for the purpose of being burnt. It is impossible to get rid of perennial weeds by merely digging them down; any of the above mentioned kinds will reappear, though covered with more than a foot of earth.

The ground, thus prepared, must receive as much dung as may be sufficient for producing a full crop of turnips, which should be sown at the usual season. It will be advisable, likewise, to give it a moderate quantity of lime, provided it has never got any before, or, at least, not for a considerable number of years. The turnips must be rigorously cleaned; and I had almost forgot to mention, that they should be sown, not in horse drills, as is usually done by farmers, but in the broadcast way; as the former method causes the dung to be unequally

distributed in the ground, while it makes the surface uneven, and thus creates an extra degree of labour afterwards. It is also proper to remark, that potatoes should never be chosen as a green crop, in preparing land for a nursery. There is scarcely a possibility of getting them clean out of the ground; and those that remain prove the most destructive of all weeds. The turnips should be removed by the end of November, and the ground thrown up in ridges, to be the better exposed to the action of the frost.

When the spot pitched upon happens to be already perfectly free from perennial weeds, a great part of the process now detailed will be unnecessary. Ridging up in autumn to a good depth, and gathering out the stones, will be all the preparation required till the time of sowing.

The above remarks embrace all that occurs to me as necessary to be said with respect to making choice of a situation for a nursery, and preparing the ground for that purpose. I shall now give some directions for its management afterwards, arranging them, for the sake of perspicuity, under the heads of Manuring, Rotation of Crops, Sowing, Transplanting, Propagation by Cuttings and Layers, Weeding and Pruning.

MANURING.

The same reasons that forbid us to place a nursery in a soil so barren, as mere theory would teach us to be necessary for the purpose of rendering the plants hardy, will not permit us entirely to discard manure. Supposing the land of the requisite strength at first, repeated cropping will at length render it unable to bring the plants to the size necessary for their standing the winter; and the application of dung is the only means we have of supplying the defect. It must, however, be given very sparingly, and never in greater quantity than is sufficient for promoting the end in view. In general, it is only ground in which we intend to raise seedlings that will ever require it. When plants have been removed from the seed-bed to the nursery-line, they are no longer in danger of being thrown out of the ground by frost; and the poorer the land is, the better will they be qualified for their future and final destination. Great poverty of soil will, indeed, make them grow more slowly than they would do in stronger land, and we will, of course, have longer to wait till they are of any given size; but this loss of time at the outset will be

more than made up by their progress after they are transported to the moors. It ought to be considered as a rule, therefore, having few or no exceptions, that ground in which we intend to transplant from the seed-bed ought not to receive dung, or manure of any kind.

Perhaps the best sort of manure for seedlings is wood-ashes, kept free from any foreign admixture; and next to them coal-ashes, in a similar state. They may be laid on, either before the ground is ridged in autumn, or previous to its being dug for the seed in spring. When excitement, rather than additional strength, is required, a little lime may be used with advantage; but this manure should not be repeated oftener than once in seven years.

ROTATION OF CROPS.

On this subject, a very few remarks will suffice. In agriculture, as well as in the kitchen garden, it is found necessary to vary the crops, so that the same one may not be many successive years in the same ground; but, in the nursery, it is generally eligible to follow the reverse of this plan. Nur-

serymen find by experience, that seedlings, especially of the fir tribes, succeed best after the ground is seasoned, as they term it; that is, after it has borne seedlings of some kind or other before. It is quite unnecessary, therefore, or rather it would be improper, to introduce green crops into the nursery by way of relieving the ground.

SOWING.

The sowing of firs is an operation which requires considerable care and delicacy. The following is a sketch of the method in which it is generally performed: The winter ridges being levelled down, the ground is dug anew, and carefully broken and smoothed with the rake. It is then divided into beds of about four feet wide, with alleys between of about eight inches. The latter are defined by stretching the line, placing a foot on each side of it, and then shuffling along, so as to make a continuous path. A coffing, as it is, in some places, technically termed, is then taken off. This operation, which is necessary for the covering of the seeds, consists in pushing off with the head of a rake, its teeth being inverted, as much earth from the bed as

is necessary for the purpose just mentioned. The earth, thus pushed off, must be made to lie in an extremely even ridge on each side of the bed, so as to occupy one half of each alley; the other being left clear for passing and repassing, as often as may be necessary, till the work be completed. The coffing being taken off, the bed is now ready for the seed, which must be sprinkled very evenly over it, the sower standing in the unoccupied part of the alley. A light wooden roller must then be passed along the bed, to prevent the seeds from being driven in heaps, when they are covered. After this, the coffing is drawn on with the same instrument used in taking it off; and, in doing so, great care must be used to spread the earth equally, so that it may be no deeper in one part than in another. The next bed is then treated in the same manner as the preceding, and so on till the whole are gone over. The line is afterwards stretched, and each alley neatly hollowed out with the spade to the depth of about half an inch, the earth being evenly spread upon the beds. The seeds of larches, Scots firs, and spruce, should not be covered more than a quarter of an inch thick; nor those of the silver fir, and Balm of Gilead, more than half an inch; and to these depths respectively the coffing must be pro-

portioned. None of them should be sown earlier than the middle of April, as the young plants are so tender that a very slight frost destroys them. No rule that can be given will be sufficient to direct an inexperienced person as to the thickness of sowing them; for among them all, but among those of the larch especially, many of the seeds never grow. When the plants appear above ground, they should not perhaps be less than an inch asunder. In some nurseries, we see them confined to less than half of this room; but the plants are thereby drawn up weak, and greatly injured.

The ground where firs are sown must be carefully protected from the ravages of birds, not only before the plants are up, but some time after; for as they carry the lobes of the seeds on their tops, when they newly rise, the birds, in taking the one, pull the radicle up also.

The mode of sowing the seeds of most other trees, is substantially the same as what has now been described, with the exception that few of them require the ground to be so finely raked, or to be treated with so much delicacy, as those of firs. A few cursory remarks, therefore, regarding the time of sowing, and one or two other circumstances, will suffice respecting them.

The ash and the plane may be sown in March, and their seeds should be covered from half an inch to three quarters of an inch deep. The seeds of the former require to be two seasons in the ground before they germinate. It is proper, therefore, before sowing them in the nursery, to keep them in a heap, covered with earth, for a twelvemonth previous.

The sweet-chesnut and the horse-chesnut may be sown at the same season as the last. They should be covered an inch deep. I might have mentioned the oak, as requiring similar treatment; but it, as we will have afterwards occasion to shew, ought never to be sown in the nursery at all.

The beech, being extremely subject to injury from frost, when it newly comes up, should not be sown earlier than April. Though its seeds are of a considerable size, they should not be covered deeper than half an inch.

The seeds of elm may be either sown in June, when they are gathered from the trees, in which case part of them will come up immediately, and the remainder, consisting of the greater number, next spring; or they may be kept dry till the March following, and sown then. They should be covered between a quarter of an inch and half an inch deep.

The birch requires rather a peculiar mode of treatment. Its seeds must be either trodden in with the feet, or rolled with a heavy stone-roller. As they must not be covered above a tenth of an inch deep, the hollowing out of the alleys, without any coffing, produces as much earth as is necessary for the purpose. In pretty moist land, I have seen birch-seed come up very well without any covering at all. The proper season for sowing them is about the latter end of April.

The alder should be slightly covered, like the birch, and sown about the same time.

The berries of the mountain ash, if sown in autumn, when they are gathered from the trees, will come up partly the spring next ensuing, and partly the following one. They may be covered an inch deep.

Laburnums may be sown any time during the month of April, and covered to the depth of half an inch.

TRANSPLANTING.

Some kinds of plants it is proper to remove to their final destination, immediately from the seed-bed; others ought to to be transplanted in the nursery. Of specifying which of these modes of treatment, however, is best adapted to the several varieties of plants, better opportunities will occur afterwards. At present, I shall offer only a few general remarks, respecting the season at which transplanting should take place, and the manner in which it should be performed.

In most nurseries, throughout the north of Scotland, transplanting is performed in spring, and this season seems to be preferable to autumn, for doing the work, as plants put out before winter are often loosened, or entirely extracted by the frost. If we transplant in spring, however, we must be careful to have it done before the plants begin to vegetate, otherwise great numbers of them will die.

There are two modes of transplanting practised in the nursery; in the one the dibble is used, and in the other the spade only. This last method is in some parts known by the technical denomination of *sheughing* or *laying*. It is very expeditious,

but as it is allowed on all hands to be injurious to the plants *, it merits no further notice. When we

* In saying that *sheughing* or *laying* is "allowed on all hands to be injurious to the plants," I have used too unqualified terms, as I have found, since this remark was written, that there are some who prefer this mode of transplanting to that with the dibble. I shall therefore describe the process, and then state specifically what appears to be objectionable in it.

In transplanting according to this method, a strip of ground is dug in the direction in which the lines are intended to run, and somewhat broader than the first is intended to be, from the boundary of the ground. The line is then stretched, and a notch made with the spade from the one end to the other, and of the requisite depth. This being done, the plants are placed with their roots in the notch, at such distances from one another as is deemed expedient, nearly in the same manner in which box is usually laid round the walks of a garden. A little earth must be drawn on the roots with the hand, as the laying proceeds, to keep them steady, and to prevent the wind from undoing the work. The whole line being finished, a little more earth is laid to the roots with the spade, and the plants are then fixed, by pressing this earth firmly down with one foot. Another strip of ground is dug somewhat broader than the interval to be allowed between the lines, care being taken not to let any of the earth fall upon the plants, and to level it neatly and smoothly, so as to be equal with that behind them. Another notch is then made at the proper distance from the first line, and so the work proceeds till the whole be finished.

Now, what appears objectionable in this method is, that

transplant with the dibble, the ground must be previously dug, and its surface smoothed with the rake. The line is then stretched, and the plants are stationed in straight rows. The perfection of this art consists in proper fixing. If the plants are only loosely stuck in, we may calculate on their not growing as a matter of course. And if we *hang them in the hole*, as it is termed, that is, close the earth firmly about the neck of the plant, which makes it appear firm to the touch, while its root is at the same time loose, the result will be similar. Doubling of the roots is also pernicious, and the hole ought always to be made deep enough to contain them straight, and at full length. In order to facilitate this, the straggling fibres should be pruned off with a sharp knife, but the woody part of the root must not be touched, otherwise the life of the plant will be endangered.

Where there is plenty of land, the plants may be put as far asunder as the owner has a mind; but

it is next to impossible to give the plants an exactly vertical position, by means of it; and lying aslant, the consequences are, that they not only become crooked near the root, but often lose their leaders, a circumstance very prejudicial to their future growth. Nurserymen are partial to sheughing, because it is more expeditious than planting with the dibble.

nothing is more pernicious than to have them too close to one another. As the distances between them ought to vary according to the species, and the time they are intended to remain in the nursery lines, it would be a fatiguing and an endless task to state these distances in feet and inches. It may, however, be laid down as a general rule, that they should never stand nearer to each other than is consistent with the horizontal branches of each plant, when sufficiently pruned, standing clear of those of its neighbour. When this is not the case, a proper supply of air is not admitted, and in consequence the plants are drawn up weak and spoiled *.

* Many are of opinion that young trees ought to undergo several transplantations, while they remain in the nursery, in order that they may be the better furnished with roots. That fibres will be multiplied by the repetition of the process, there can be no doubt, though, when all things are considered, it will perhaps appear that this advantage is attended with disadvantages, which fully counterbalance it. In the first place, nearly a year's growth is lost by each removal; and, secondly, the repeated checks which the plant thus receives must have very injurious effects on its constitution. Besides, in the soft ground of the nursery, and at the age when young trees are, or ought to be, removed from it, they never fail to be well provided with fibres, independently of art altogether. The repeat-

PROPAGATING BY CUTTINGS AND LAYERS.

The trees commonly propagated by cuttings are the poplars, with the exception of one variety mentioned below, and the different kinds of willows. Cuttings may be planted in the month of February or earlier. They should be a foot or fifteen inches in length, and of the last summer's growth. They should be planted in a moist spot, and thrust at least four inches into the ground, the buds being rubbed off to this length to prevent the rising of suckers.

The silver poplar and lime are propagated by layers. In order to provide stools for this purpose, get as many plants as may be deemed necessary, place them in a moist situation, and cut them down within three or four inches of the ground. They will send forth young shoots, which, in a year or two, will be fit for laying, which is executed in the fol-

ed removals, therefore, which are so highly recommended by certain persons, may be regarded as one among many of those ingenious artifices, invented for the laudable purpose of rendering the culture of trees as complicated and expensive as possible.

lowing manner. Raise a circular mound of earth three or four inches high all round the stool. Bend down the branches or shoots, till they come in contact with this mound, and fix them with hooked pegs of wood made for the purpose, so firmly that their extremities may assume a nearly vertical position. Cover them with earth at the place where they are fixed with the peg, and press it firmly down. They will require no more trouble, till they are rooted and fit to be separated from the parent plants, except being kept free from weeds.

WEEDING.

This must be sedulously attended to in the nursery, otherwise every other labour will be in vain. The weeding of seedlings, especially of firs, requires considerable attention. A careless hand will pull up thousands of the plants along with the weeds, in the course of a single day's labour. The latter should be taken when very young, otherwise it will be impossible for the most experienced person to pull them out, without doing mischief: Whoever is employed in this work must sit or kneel in the alleys, without leaning on the bed with his hands, or other-

wise, as the plants are so brittle that they break with the least pressure. Among transplanted lines, the hoe may be used, but the weeds in immediate contact with the plants, must be pulled out with the hand, to prevent the latter from being barked or loosened.

PRUNING.

Every kind of young trees except firs, which remain for any considerable time in nursery lines, should be carefully pruned. As, however, this operation should be conducted in the nursery, on precisely the same principles as in the forest, with reference to which, we will have afterwards occasion to treat the subject at some length, it is unnecessary to enter upon it at present.

In concluding these remarks, it may be proper to observe, that, as some of the above operations require a considerable degree of manual dexterity, it will be necessary for the right execution of them, that a person be employed for that purpose, who has previously been accustomed to work in the nursery.

SAVING THE SEEDS OF TREES.

As the preservation of the seed of trees is an object of some importance, where a nursery is kept, and attended, in certain cases, with considerable difficulty, it may not be improper to give a sketch of the way in which professional seed-gatherers conduct the business.

The trees whose seeds give the most trouble are the fir tribes, especially the larch, the cones of which require the application of a high degree of heat, as well as much laborious percussion, before they will allow the seeds to escape.

The time for gathering the cones of the larch is during the winter months. This part of the process is easy, and consists merely in plucking them from the trees. It is proper, however, to select the finest and most thriving trees for this purpose, to prevent, as far as possible, any chance of the species degenerating. The larch begins to bear cones very young, and its seed is said then to grow more certainly than when the tree is aged. As the gathering proceeds, the cones should be laid somewhere out of the reach of wet, which, if admitted to them, will tend to make the process of taking out the seed more tedious.

From twenty to twenty-seven bolls of them are generally required to produce a hundred-weight of seed. When there is a good crop, and the trees young, so that little time is lost in climbing, a man who is expert at the work will gather half a boll a-day.

After gathering the cones, the next operation is to extract the seed. This is a most laborious process, and requires, besides, some skill and a considerable degree of care. For this purpose, it is necessary to have the use of a kiln, and of a barn with a good floor. The kiln must be well heated before any of the cones are put on, and to as high a temperature as may be deemed safe for the seed; that is, so high as to be efficient in taking it out, without subjecting it to the danger of being scorched or burnt. It is matter of regret that the precise degree of heat which is necessary has never been ascertained by means of a thermometer; and this not having been done (so far at least as has come to the knowledge of the writer of these pages), there is no alternative but to leave the operator to the dictates of his own judgment on the point. Perhaps the safest plan for an inexperienced person, would be first to make an experiment with a few pecks of cones, before he risk a greater quantity. If the seed appears,

on being beat out, to be in the least degree discoloured, then the heat has been too great, and must be diminished before any more cones be put on. If, on the other hand, none of the seed come out after the cones, while hot, are subjected to smart percussion with a flail, it is plain that the heat has either been too mild, or that it has not been applied for a sufficient length of time; and the error must be corrected, according to the nature of the case.

The cones are generally laid upon the kiln to the depth of five or six inches; and a smart heat being kept up, they are allowed to remain for two or three hours; but they must be repeatedly turned during that time, in order that they may all receive equal justice. When taken off, they are laid on a smooth barn floor, and beat violently with flails till they be perfectly cold. They are then put upon the kiln a second time, care being taken, in the first place, to separate from them what seed may have come out, by sifting them in a riddle or wide sieve. After being again heated for a considerable time, they undergo another severe beating, which, if it pounds and breaks them completely, finishes the most laborious part of the operation; but, if a considerable number of them still remain whole, they must again be sifted, and put upon the kiln, and subjected a

third time to the flail, when taken off. In order that the beating may prove efficacious, it is absolutely necessary that it be commenced as soon as the cones are taken off the kiln; that is, when they are hot: and it is of no use to continue it after they have become completely cold. Persons who have not had much experience, would do well rather to subject themselves to the labour of shifting and beating four times, than, by keeping the cones too long on the kiln at once, run the risk of entirely spoiling the seed. In order that no time may be lost, it will be advisable to have hands for filling the kiln with new cones, and taking care of it, while others are employed in beating. If the same hands that beat have likewise to fill the kiln, the cones last taken off will have time to cool considerably in the interval; and, again, while they are employed in beating, the cones on the kiln will suffer for want of attention; while, in the third place, if the kiln be allowed to remain empty, so much time is necessarily lost.

The seed, when taken out, requires to be cleaned. This is done either with a wire sieve, made for the purpose, or with a riddle, such as is used for giving the last dressing to barley, which is the preferable implement of the two. The seed being sifted with either of these, in a gentle wind, all the larger par-

ticles will be kept, while the dust which passes through will be carried off, as the chaff in winnowing corn. It is customary to give the seeds a sprinkling of water after they are dressed, for the purpose, as is said, of restoring the substance they have lost in being dried. They may then be spread pretty thin in a loft for two or three days, and afterwards put into bags.

The cones of Scots firs are much easier to deal with than those of the larch, though, like the latter, they require also the application of heat, before they will part with their seeds. If the kiln be well heated before they are put on, they will seldom require the fire to be kept up. A declining heat is best for them, as many of the seeds fall out while on the kiln, and are very liable to be scorched. One beating will suffice, after which the seed must be cleaned, and put into bags.

The seeds of the spruce part with the cone still more readily than those of the Scots fir; and the greatest care is requisite, in order to prevent them from being injured while on the kiln. It is not unusual to spread mats or pieces of canvas under them, to preserve them the more safely from the effects of too great heat. One moderate beating will

separate them completely, after which, they being cleaned, the operation is finished.

The kiln most proper for drying fir-cones is one floored with brick; and the best fuel, the husks or remains of the old cones themselves. As they, however, contain a considerable quantity of resinous matter, much caution must be observed in using them, otherwise serious accidents will ensue. I have heard of a seed-gatherer who rendered himself famous in every district which he visited in the way of his profession, by setting kilns on fire.

On the saving of the seeds of other trees, little need be said; little, in fact, can be said, that is not commonly known. The most important point is not to gather them till they be thoroughly ripe. This will be the case with the keys of the plane, in September, and those of the ash in October, though, as the latter, as well as the pods of the laburnum, hang on the trees long after the leaves have fallen, they may be gathered almost at any time during the winter months. To know whether the seeds of the alder be ripe, cut up the cone with a knife, and if they are of a deep brown colour, they may be considered as having arrived at a state of maturity. October is the month in which they are commonly gathered. The seed of the elm is ripened early in

summer, but its maturity ought not to be taken for granted, till it begin to drop spontaneously off the trees. This rule ought to be strictly observed in gathering birch-seed, as, if it be taken off the trees a fortnight too soon, little of it will grow. It is generally ready about the beginning of harvest. The seeds of the beech and oak are seldom saved in Scotland. Every one knows when such seeds as are produced in the form of berries are ripe, by their colour.

Seeds may be greatly injured, or rendered entirely useless, by being kept in bags, or laid in large heaps, when they are newly gathered. By this means, they heat or ferment,—a process which induces rottenness, and destroys the power of germination. Birch-seed especially may be completely spoiled by being kept two days in bags, when it is newly collected. It is necessary, therefore, to spread all seed liable to be injured from this cause, on a loft or dry earthen floor, as soon as gathered, and to turn it once every day, till all its superabundant moisture have evaporated. Seeds ought to be kept free from damp during winter, but they should not be kept where the heat of fire may reach them. To shrivel them is in the highest degree injurious, though this is a fact that is seldom attended to.

CHAPTER III.

PURCHASING PLANTS.

It is only those who plant on an extensive scale, and intend to do so for a series of years, that can be expected to have nurseries of their own. Proprietors, who have only a small extent, which they wish to turn into woodland, will, in general, be averse to incur the expense of setting a nursery on foot, and will rather choose to purchase their plants from those who raise them for sale *. Indeed I am far

* Monteath has advised the adoption of a middle course, namely, that those proprietors who plant extensively, should not attempt to raise seedlings, but purchase them from professional nurserymen; and place them in a succession nursery of their own, till they arrive at a proper size for being sent abroad to their final destinations. This suggestion is a good one, and deserves notice. A proprietor may, in general, purchase seedlings much cheaper than he can produce them at home, while the case is just the reverse with regard to plants of a greater age. In raising seedings, much skill and attention are requisite, which the professional man can always command

from thinking it so indispensable to the interests of planting that proprietors should become their own nurserymen, as some would represent it. That such a practice would have some advantages peculiar to itself, there is no reason to doubt; but I am persuaded that these advantages will be found, on a fair trial, to be both fewer, and of less importance, than many would lead us to suppose. Those who recommend that every person, who intends planting, should raise his plants himself, always take it for granted, that our public nurseries are universally conducted on wrong principles. This, however, is not true *. In some of them, indeed,

at a much more reasonable rate than the proprietor. In the treatment of plants after they are removed from the seed-bed, the rent of the ground in which they are placed is the chief source of expense, as any common gardener will be able to manage them. Now, in the country, where the estates of all who have waste lands to plant universally lie, rent is often below one-tenth of what it is in the neighbourhood of large towns, where public nurseries are, for the most part, situated. In addition to these considerations, the plan here recommended will enable the planter to put his young trees in such soil as he may deem best adapted to prepare them for their future stations.

* I know of no reasonable objection that lies against *any one* of the public nurseries in this country, different from what

the plants are raised more delicately than is consistent with their future thrift; but this is not the case in all, nor perhaps even in the greater number. Whoever has skill to select, will find abundance of every kind of plants to purchase, as hardy as it is possible to raise them, and those who find it inconvenient to have nurseries of their own, have themselves to blame, if their plantations are less thriving on that account.

A general, and a very gross error in purchasing plants, is to consider those as best which are the largest in proportion to their age. This absurd principle of selection makes those nurseries most frequented by customers which least deserve to be so; such, namely, as are situated in the richest soil, surrounded by the closest shelter, and stimu-

is involved in the three following points, viz. When the soil is too fertile and closely sheltered; when manure is applied too freely; and when the plants are crowded too thickly together. Now, though the nurseries that may be chargeable with all the three errors are, no doubt, more numerous than is desirable, I believe that they bear but a small proportion, compared with the whole; and I know that many are as free from any of these objections as in practice is attainable. If the purchasers of plants would only shew a little more discrimination than at present they do, the most exceptionable of our nurseries would soon be greatly reformed.

lated by the greatest quantities of manure. It is necessary, no doubt, that plants should be of a size to qualify them for being removed, and suit them to the situations for which they are intended; but if they have attained this size sooner than the due time, by being forced, they are in the worst state imaginable for growing in a barren moor, or the bleak side of a rugged mountain.

A seedling larch is large enough for being removed to any situation to which it is proper to transfer it, if the part of it above the ground be an inch or an inch and a half long; and if it exceed two inches, we may conclude that it has attained this extra size, by being forced, and is consequently deficient in hardiness. Other circumstances being the same, the growth of any plant will vary according to the temperature, the wetness or dryness of the season. But two inches, exclusive of the roots, may be regarded as the maximum size to which a seedling larch will grow, in land that is not too strong, and where the local heat is not rendered greater than the general warmth of the air, by close shelter. Scots firs of two years old, the age at which it is most proper to remove them from the seed-bed, should not exceed two, or at most two inches and a half in length, above the surface of the ground.

This species is more injured by being forced in the nursery than perhaps any other, and Scots firs that are large in proportion to their age, should on no account be selected, if we wish our plantations to flourish.

In general we will find, that, as the strength of the land, and other circumstances which affect vegetation, are proportioned to the crop in one part of a nursery, so will they be in all the other parts of it, at least this will be the case where any regard is had to consistency. We may, therefore, make any one kind of plants a standard for judging of the qualifications of all the other kinds raised under the same management. Taking, then, one-year old larches, or two-year old Scots firs in the seed-bed, as this standard, if we find them of a size that bespeaks them hardy, we may safely conclude; in general, that all the other kinds in the same nursery are proportionally so, and *vice versa*. Hence the inexperienced purchaser may judge with tolerable accuracy of the hardiness of every kind of plants in any nursery where there are Scots firs and larches, or either of them, of the respective ages above mentioned, by attending to what is said in the paragraph immediately preceding.

Plants are often much injured, though raised sufficiently hardy in other respects, by being too much crowded, whether in the seed-bed or in the nursery line. When this is the case, many of them grow very slowly. It is necessary, therefore, to be carefully on our guard against purchasing such as have suffered from this cause. The surest method, that I know, of enabling those who have little experience, to ascertain whether plants in the seed-bed are too much crowded or not, is to compare such as grow on the verge of the alley with those in the interior. If the girt or thickness of the latter be equal, or nearly so, to that of the former, it may be taken for granted that the plants have had sufficient room; but if there be a considerable disparity between them in this respect, the opposite conclusion is the true one. When plants of any kind are too close upon one another, they are drawn up weak, that is, with their stems too small in proportion to their length, and this is occasioned by the air not being admitted in due quantities. The plants, however, near the edges of the beds cannot suffer on this account; and, by comparing them with those which grow in the middle of it, any person may easily judge whether the latter have sustained injury from the cause in question. When plants have stood

for several years in nursery lines, and have arrived at a considerable height, if they are too much crowded, many of their lower branches will be in a half decayed or withered condition, or the stems will be entirely devoid of branches of any kind, excepting within a few inches of the top, even where the pruning-knife has never been applied. This is a mark so plain that no one can mistake it.

Care should be taken not to purchase plants that betray symptoms of disease. When larches, not more than three years old, cast the whole, or even the greater part, of their leaves, just when the winter commences, it is a sure sign that they are in an unhealthy state, and that many of them will die in the course of next season; for under this age the larch should retain a considerable quantity of its old leaves till spring. Scots firs may be regarded as sickly when the points of their leaves or pins become withered, or when they change their naturally dark colours into a faint yellowish green. Any vestige of withering on the Spruce, Silver, or Balm of Gilead firs is a sure prognostication of approaching decay. Any kind of fir whatever that has lost its leader may be considered as entirely useless.

The birch is sometimes infected with a distemper which appears in red spots or blotches on the leaves.

This disease generally ends in the death of the plants, yet they often retain a lively appearance during the whole of the winter after they have been attacked by it. In purchasing birch, therefore, it is proper to see and bespeak them in summer, when it may be ascertained by barely looking at them, whether they are in this morbid state or not. I should have observed, likewise, that the minute white insect, which is so fatal to the larch in plantations, sometimes, though more rarely, and never before the plant has entered its second year, attacks it in the nursery. It is proper, therefore, to take the same precaution in purchasing larches more than one year old, as has just been recommended with regard to birches.

These are all the kinds of forest trees that I have observed to be liable to disease of a serious kind in the nursery; or the distempers incident to other varieties are not, at least, of that insidious kind which make progress, while the plant may seem, to the inexperienced eye, in a state of perfect health, and thus lead to deception.

In commissioning plants from such a distance, that it is necessary, for the sake of convenience of carriage, to pack them up in mats or otherwise, strict orders should be given that those which carry

their leaves in winter be taken up when they are entirely free from moisture. If they be pulled wet, they will heat and get mouldy in the packages, in the course of a few days, and good plants are often completely spoiled in this manner. Much injury is often done, likewise, by letting plants that come from a distance be too long out of the ground. The nurseryman from whom they are ordered, therefore, should get directions not to pull them but as short time as possible before there is an opportunity of sending them off; and, as soon as they arrive, instead of laying them up in a shed, as is often absurdly done, their roots should be well covered with earth, and no more of them exposed at once than can be planted in a day.

CHAPTER IV.

ON THE QUALITIES OF SOIL MOST PROPER FOR THE DIFFERENT VARIETIES OF FOREST TREES; WITH REMARKS ON ASPECT AND ELEVATION.

It is evidently a great error, if we plant with a view of pecuniary advantage, to put a less valuable kind of timber into ground, capable of producing a full crop of a more valuable kind.

There are cases, however, in which we may sustain an equal, or even a greater loss, by following an opposite course; for, on some lands, we will gain most by cultivating the sorts of wood that sell *lowest* when brought to market; on the same principle as the farmer often finds his account more in raising a crop of oats than one of wheat. Fir-wood, for example, is in general worth less per solid foot than ash; yet there are many soils which will produce a quantity of the former so much greater than they will do of the latter, as to render

fir, almost beyond comparison, the more eligible crop. Land which is proper for Scots fir, is very improper for spruce; and, though the selling price of both is nearly on a par, a proprietor will lose at least a hundred per cent. by planting either in land which is naturally adapted for the other. In order, therefore, to secure the greatest possible return of profit from a plantation, it is necessary that we should form it of such kind of trees, and of such only, as agree with the nature of the soil. This is a rule, which, either through ignorance or negligence, is often grossly violated. Some planters, in the distribution of their trees, seem to have been guided solely by chance. We often find the fir tribes encumbering ground, which might have been much more profitably filled by the elm, the beech, or the oak, and either or all of the last mentioned species languishing, and of scarce any value, where the former would have been a lucrative crop. The effects of this error, attributed to a wrong cause, have, in some instances, given rise to a prejudice, that whole estates, and large tracts of country, are utterly incapable of producing any kind of wood. Frequent failures, for example, in attempting to rear the Scots fir, in a soil and climate both eminently unfavourable to it, but well calculated for the growth of

several other species, have stamped a character of this kind on the extensive and fertile district of Buchan, in Aberdeenshire.

To contribute as much as possible towards the prevention of the error in question, I shall point out, as far as my experience extends, the kinds of soil best adapted for the several varieties of forest trees, which are most generally cultivated; and, in order to make the labour of ascertaining the quality of waste lands intended to be planted, as easy as possible, I shall add, in a subsequent chapter, some rules for that purpose, founded on the nature of the wild plants which such lands naturally produce. Here, as in the other parts of the work, I shall furnish the reader with the data on which my own opinions rest,—that he may, with the greater facility, judge with regard to their correctness.

The most convenient method of treating this part of the subject, will be to go over the different species of trees, one by one, and I begin with the *Scots fir.*

This is one of the hardiest trees we possess, and it will thrive in very barren situations, provided they be dry. Dryness is, in fact, the most indispensable requisite that land can possess, in order to produce a good crop of Scots fir; and it is never advisable to plant this tree in very moist ground, or where

draining is necessary, to carry off the surface water. The soil most favourable to it is, perhaps, a sandy loam, but it will thrive on light soils in general, on a substratum of gravel, or even of solid rock, provided there be as much vegetable mould as to permit it to fix its roots. Gigantic specimens of it are to be seen in the district of Braemar, in Aberdeenshire, in situations where its fibres have found no better lodgment than the chinks and crevices of granite. The finest Scots firs any where to be met with, occur in the neighbourhood of the river Dee, in the above mentioned county, especially in Mar forest, the property of the Earl of Fife; the forest of Glentanner, the property of the Earl of Aboyne; and the woods of Invercauld, belonging to Mr Farquharson. In all these places the ground is mountainous, wild, and rugged, and the subsoil varies from the poorest quality of sandy loam to gravel and rock, but in no instance that I recollect does it approach to clay. On the banks of the Don, a neighbouring river, where the soil, in general, has more tenacity, the Scots fir is not found in nearly so great perfection. Stiff land, indeed, seems to be decidedly hostile to its growth, as we scarce ever find it either plentiful, or of large size, in districts where clay abounds. It is very impatient of the spray of the sea, and hence comparatively few thri-

ving woods of it occur on the east coast of Scotland. Mountainous regions are its most favourite situations, and in these it will thrive at a greater elevation than any other species of timber, with the exception of the mountain-ash and the birch. On a deep rich soil it grows very fast, attains a large size, and soon decays. In these circumstances its wood is spongy, and of inferior value. But, on such land, it is not eligible to plant the Scots fir, whatever were the quality of its timber, as there are other kinds of trees which will bring higher profits to the proprietor. The most important precept that can be delivered with regard to this tree, is never to plant it either in *wet* or in *very stiff* land. Whoever wishes to see it in its highest perfection, and to acquire a knowledge of the soil and situation in which it delights, from personal observation, ought to visit the forests of Deeside.

Next to the Scots fir, the forest tree most universally cultivated is the *Larch*. This is also a very hardy plant, and it is sure to thrive on any land that will answer for the Scots fir. It is, however, less delicate in its choice of soil than the latter, and will grow in a much greater degree of moisture. I have seen fine larch trees on very stiff land, and I understand there are many such in the neighbour-

hood of gentlemen's seats in the Carse of Gowrie, where the soil is deemed as tenacious as any in Scotland. This tree is one of the surest growers we have in barren soils; and, where a proprietor is in doubt what kind of wood he should plant in any piece of tolerably dry waste land, it is a good general rule to put in a considerable proportion of larches, or rather to make them the staple of the plantation.

The next most generally cultivated of the fir tribes is the *Spruce*. It is as partial to moist land as the Scots fir is to dry; and, in this particular, these two species stand directly opposed to one another. Nothing possibly can be a greater error in attempting to rear timber, than to plant spruce in ground that has not a very considerable degree of moisture. It may, indeed, appear to thrive in a dry situation for a few years; but, by the time it reaches ten or twelve feet in height, its lower branches will begin to decay, and, after that period, it will make little progress, but remain a mere cumberer of the ground, as unsightly as it will be unprofitable. If well supplied with moisture, it will thrive better on the most indifferent land, than without that requisite, it will do on the best of soils. At Countesswells, within five miles of Aberdeen,

there were standing, a few years ago, and probably still remain, some spruce trees upwards of fifty feet high, and without a single withered branch from top to bottom. In shape they presented an exact copy of the cones that grew on them; the branches close at the ground, spreading out to a great circumference, and every succeeding row diminishing somewhat in length till the conical shape was complete. So thick and close were the boughs, that it was impossible to catch a single glimpse of the trunks. These beautiful trees grew on what had formerly been a perfect morass, the surface water of which had been drawn off by opening large ditches. The soil was peat moss on a bed of poor clay. I may state, in the way of contrast, that I have seen, on dry land, where the larch had grown to a majestic height, spruce, of the same age, not exceeding fifteen feet from the point of the leader to the ground, every branch, with the exception of two or three near the top, being as effectually withered as if scorched by fire. Spruce seems to be most partial to a cold stiff clay; it is, however, a very hardy plant, and not very nice in its choice of soil, provided it have enough of sap. It is to be observed, in recommending moist land for this tree, that I do not mean such as is deluged in winter with stagnant

water. This is incompatible with the growth of wood of every kind. Before even the most aquatic trees will grow in a bog, it is necessary that the surface-water be drained off.

The *Silver fir* and *Balm of Gilead* will answer in the same kinds of land as the spruce. They are both very hardy, and great lovers of moisture. There are some beautiful silvers at Skene, in Aberdeenshire, in a piece of ground where the soil is deep peat-moss. They, together with the spruce, are invaluable for land of this description, as neither the Scots fir nor the larch will thrive in it, and it is equally sterile with respect to most of the hard-wooded kinds. The above kinds include all of the fir tribe (among which I have enumerated the larch), which we cultivate largely for the sake of their timber. I proceed next to point out the qualities of soil most proper for deciduous trees.

Of all this class the *Oak* deserves the highest consideration, on account of the value and general usefulness of its timber. The soil in which this tree will grow to the largest size is perhaps a strong clay. Some very fine specimens of it, both as regards size and beauty, grow on land which, if I mistake not, is of this quality, in the front of Glammis

Castle, in Forfarshire. Throughout the Valley of Strathmore, the best oaks, as far as my observation has reached, occur in the same kind of soil; and the fact, that some of the largest trees of this description in Scotland are to be found in the Carse of Gowrie, seems to confirm the position I have here laid down. But, though the oak may require a rich clay to bring it to its maximum growth, it is by no means a tree that is delicate with regard to soil. It thrives well in good loam, and I have seen it in a considerable degree of perfection, not only in sandy and gravelly, but even in rocky land. It is to be found in all these varieties at Inchmarly, Blackhall, Invercauld, Monalterie, Abergeldie, &c. on Deeside. From the quality of the substratums on which the remains of oak are often found in peat-mosses, we may safely infer that it will attain no contemptible size in soil which is of but very indifferent quality; and also, that it will bear a considerable degree of moisture. As this country, indeed, appears at one time, to have been nearly covered with oak forests, it would seem that it will thrive on a greater variety of soils than almost any other tree we possess. We may at least assert, that, with proper management, it will grow to a size fit for many of the purposes to which it is commonly

applied; in any land well calculated for larch or Scots firs. There are at Careston, in Forfarshire, some very thriving plantations of oaks, which have arrived at a fair size, on ground so moist as to have produced a good crop of spruce. I am aware that what I have here advanced concerning this tree, will be disputed by many planters, especially in the north of Scotland, where an opinion is very common, that it is only in some few much favoured situations, that plantations of oak will ever be good for any thing. Of this opinion I shall have occasion to speak at greater length in another place; at present I only remark, that it has had its origin solely, in the very inadequate, not to say absurd and preposterous methods, which have been adhered to in attempting to propagate the tree in question. To explode these methods, and to introduce better in their place, were the principal objects which led me to undertake the present work; and, if the plan of propagating oak, laid down in the subsequent part of this volume, be generally adopted, I feel confident, that every complaint about the incapability, whether of our soil or climate, to produce it, will soon be hushed. In every part of the country, the planters of oak have all along proceeded on a system which is hostile to its nature; but, in the

northern counties especially, it is generally put into the ground in so slovenly a manner, that I do not account it matter of half so great wonder, that plantations of oak should have so often proved abortive, as that any of them should have even partially succeeded. But to return: As oak is useful for many purposes, and therefore in request, even when of diminutive growth; and as, in addition to the value of its wood, the bark brings a high price, so an indifferent crop of it will often be more profitable than a full one of most other kinds of timber. With regard to it, consequently, the rule which ought to be observed in other cases, namely, to plant such kinds of trees as the land will bring to the greatest perfection, does not hold good.

The deciduous trees next in importance to the oak are the ash, the elm, the plane, and the beech.

With regard to the first of these, the *Ash*, it is in vain to plant it in poor land, or where there is not a very considerable depth of vegetable mould. On shallow ground, which is apt to run dry in summer, it grows extremely slow, and never attains a large, or even a respectable size. I have never seen it thrive well in peat-moss, or in land that has a tendency to that quality. It should not be planted in rocky or in gravelly soils, as these never furnish suf-

ficient nourishment to bring it to any tolerable degree of perfection. It does not answer well in very high situations. Its most favourite soil is a deep loam, but it will thrive well in any rich land, that, without being wet, is not liable to be parched by the summer droughts.

Hard shallow land is as inimical to the *Elm* as to the ash; perhaps the former is still more decidedly partial to a deep soil than the latter. The element in which this tree most delights, seems to be a deep rich clay, where the ground is moist, without being wet. Having a sufficient depth of earth, it will, however, succeed well in loam. The principal rule to be observed in planting elm, is to avoid shallow and dry soils of every description. I do not recollect having seen any good specimens of it in peat-moss.

The *Beech* thrives in a greater variety of soils, and in more exposed situations, than either of the last mentioned trees. A strong loam, or clay, is perhaps requisite for bringing it to its utmost perfection, but it often attains no contemptible growth in land of a quality much inferior to either of these. I have seen it of a good size in a gravelly soil, as well as in other situations, where the ash and elm were stunted and good for nothing. Gigantic spe-

cimens of this tree are to be seen at Brechin Castle, the seat of the Honourable WILLIAM MAULE, M. P., growing in a very exposed situation, where the soil is a sandy loam, or rather inclining to gravel. The beech ought never to be planted either in mossy or in wet ground.

Any light dry soil, where there is a considerable depth of vegetable mould, will answer with the *Plane*. It will, however, grow in good land of a tenacious quality, where there is not too much moisture. The plane is averse to peat-moss and wet land in general.

The horse-chesnut, the lime, the birch, the alder, the poplar, and willow tribes, are kinds whose timber is of less value than any of the above mentioned kinds. With the exception of the birch and alder, they are generally planted for ornament, rather than with a view to profit. It will be necessary, however, to point out briefly the qualities of soil most proper for each.

The *Horse-chesnut* and the *Lime* thrive on the same kinds of land as the ash and elm.

The *Birch* delights in mountainous regions, as is evident from its abounding in almost every part of the Highlands of Scotland, where any kind of wood is to be found. We may consider the same fact as

a proof that no ordinary degree of sterility will prevent it from answering the expectations of the planter. From the frequent occurrence of this tree on Deeside, and the high perfection it there attains, we may conclude that it is partial to light and dry soils. But its growth is by no means confined to these. We meet with good specimens of it, in all the different varieties of clay; and it will bear a degree of moisture equal to the spruce. Of all the forest trees known in this country, the birch may, in fact, be deemed one of the least delicate with regard to soil. It will grow in loftier situations than even the Scotch fir or the larch.

The *Alder* is properly a marsh plant. It is not, however, so exclusively such, but that it will thrive on any but the very driest kinds of land. It will answer in cold boggy soils, where scarce any thing else will grow, and to such situations it should be banished.

The Willow tribes, though proverbial for their love of moisture, will yet most of them answer well in land which is not too dry for the elm. Excepting those species, which belonged originally to this country, they require a good depth of vegetable mould, to bring them to their full growth. A light

black earth is most suitable for them, but they may be planted with success in stiff lands of a good quality. Two species have already been mentioned; the one with a broad scented leaf, of a shining green colour; the other with woolly leaves, a greyish bark, and, in spring, bearing a large catkin. These are the kinds which are proper for the sour stiff morasses that so often occur in our waste lands. If the golden, or the Huntingdon, or any other of the finer species of willows, be planted in such situations, they will scarce live, much less make any progress in growing.

All the Poplar tribes will thrive in the same quality of land with the finer species of willows, or, if there be any exception to this, it is, that the white, or Lombardy poplar, is less fond of moisture than the rest, and will attain a good size even where the soil deserves the epithet of dry. Unless the aspen, which is a native of Scotland, none of them will come to perfection, but in a tolerably rich soil. The sides of streams, and places where the land is of an alluvial nature, are most proper for almost all the foreign species of poplar. But the aspen, or quaking ash, as it is sometimes called, will thrive on very dry and barren land, and at a great elevation. On the estate of Abergeldie, there is a hill more than

When stout plants of the common broom grow abundantly among thriving heath, they furnish an unequivocal criterion of superior fertility. In land that produces this plant, we may expect the larch and the Scots fir to attain a very large size. We may also plant in it the oak, if it is situate on a declivity, and in addition to these, the beech, if it lies in a hollow or ravine, with every prospect of success.

Furze or *whin* is a much less unequivocal indication of the qualities of soil than any of the plants we have yet mentioned. It springs up on the best as well as the worst of soils, and it is rather from its size than its mere presence that we can draw any conclusion as to the quality of the land where we find it. When it is dwarfish, and has no large stems or branches, although it be, at the same time, green and healthy, we may take it for granted that the soil is very poor; but if, on the contrary, the stems are large and gigantic, they indicate a quality of land not inferior to that which produces broom. Furze, however, is on the whole a very uncertain criterion by which to judge of soils.

Wherever we find any of the species of fern or *braken* in pretty large quantities, we may safely conclude that the soil is of the most fertile quality of any

directly, it has some compensating advantages not possessed by the latter. It is less exposed to partial thaws in winter, which, by causing the snow to melt, leave the ground more exposed to the intensity of the frost; and is likewise less influenced by the violence of the south-west winds, which are often so chilling in spring and autumn; and, by blowing during the season of vegetation, do more injury than those from the north, which prevail most when the sap of vegetables is at rest. Hence we find, that the Scots fir is not only of the largest size, but best as to quality of timber, in northern aspects; and even that the hard-wooded species, which require a higher degree of heat to bring them to maturity, grow as quickly, and attain as great a height, in a north as in a south exposure, other circumstances being equal.

The elevation of the ground in which we plant is a matter of much greater importance than its aspect; and, with regard to it, the statement of the following facts may be useful:—It is well known, that, as we ascend in height, the temperature regularly decreases, and this is the reason that trees, which grow at the foot of a high mountain, will not thrive at its top. By attending, therefore, to the observations of naturalists and travellers, with re-

spect to the trees found in regions of various degrees of heat or cold, we may form a pretty accurate estimate of the heights at which they will thrive relatively to one another.

Now, we are told that the trees which reach nearest to the limit of perpetual snow, and within a very few degrees of it, are the Scots fir and the birch, reduced, in their nearest approach to this inhospitable region, to the stature of scragged shrubs. A degree or two farther south than this utmost verge of vegetation, the spruce is found at first in a very diminutive state. After it, still farther south, succeeds the oak, then the beech, and, last of all, the Spanish chesnut. The ash, elm, lime, &c. belong to the zone of the beech. In like manner we are told that, at the foot of the Alps, the chesnut flourishes, the beech continues after the former disappears, and the oak rises to a height where there are found no beeches. After the oak itself has vanished, the pine continues diminishing regularly in size, till it approaches the boundary of perpetual frost.

These observations furnish us with the elevations at which trees will thrive, relatively to one another, in all countries; as to absolute heights, they must, of course, vary in different climates. The utmost

height at which the Scots fir grows in Scotland, even of the size of a large shrub, is said to be 2000 feet. In most places, however, it does not ascend half so far. I should conceive 700 or 800 feet to be the greatest altitude to which it attains any where within twelve miles of the sea-coast. Assuming 900 feet, as the medium height attained by it and the birch, we may assign 600 feet for the oak and larch, and 400 for the beech, with the other trees that belong to its zone. Even at the extreme points of these elevations, we must look in general for nothing but dwarfish scragginess. Wood is said to thrive in Perthshire, at a greater height than any where else in Scotland. This may be accounted for, partly by the distance from the sea, and partly from the mountains, in many places of that county, being piled so closely together, as to reflect back the rays of the sun upon each other, and afford mutual shelter.

CHAPTER V.

DIRECTIONS FOR ASCERTAINING THE QUALITY OF WASTE LAND FROM THE NATURE OF THE WILD PLANTS THAT GROW ON IT.

In the foregoing chapter I have endeavoured to describe the qualities of soil best adapted for the various kinds of forest trees. The most obvious way of ascertaining these qualities, is to inspect the ground with the spade or mattock, by which means the depth of the vegetable mould and the nature of the subsoil may be known. This, however, is a laborious task, as, in any considerable extent of land, there would be occasion for a multitude of trials, and, after all, those who had not previously formed some acquaintance with the nature of soils, would be liable to form very wrong conclusions. An easier rule for ascertaining the quality of waste land, and one which is much less apt to lead into error, may be deduced from the character of the wild plants which

naturally grow in it. Different kinds of these indicate different degrees of fertility or sterility in land, with as great precision as different heights of the thermometer point out various degrees of heat and cold. Nor is it necessary for the object of the planter that he should be a skilful botanist, and know by name, as well as by sight, the immense variety of wild plants that spring up on our mountains and in our glens. There are half a dozen species, or a few more, so common as to be in the catalogue of every herd-boy; and, according as one or other of these occur, and some of them occur in every piece of waste land that produces any thing, we may determine with the greatest accuracy and readiness what kind of trees we ought to plant. In the present chapter, therefore, I shall lay down a few rules founded on this principle; and, I trust, they will be so plain and simple, as to render it impossible, even for the most inexperienced person, to misapprehend them.

The plants which, as being known to every one, may be considered as most suitable for my purpose, are the grey lichens or moss, the rough benty grass, the heath, the furze and broom, the fern, the juniper, and a few others, which will be noticed in their place.

The grey lichen or moss deserves to stand at the head of such plants as indicate the most barren kinds of soil. Where it is found alone, indeed, it denotes a degree of sterility in which no other plant can subsist. It is scarce found, however, in a solitary state, but at a great altitude, where the rigour of the climate conspires with the badness of the land to prevent any other plant from vegetating. In such situations, it would, of course, be the height of folly to plant trees of any kind. When this moss grows thickly, as it often does, among heath, the soil may be considered a degree better than that in which it is found alone; but still of so inferior a quality as to be incapable of bringing trees of any kind to a size, that will render them valuable as timber. If we plant such land, therefore, all that we can expect is bushes, the only use of which will be, to take away a portion of bleakness from the prospect, or afford an indifferent shelter for game. Even to secure these subordinate objects, we must plant none but the hardiest species of trees; such as the alder, the birch, the coarser kinds of willows, and a few spruce, if the land is wet; and the larch, birch, mountain ash, and Scots fir, if it is dry.

The coarse benty grass is found only in land, very little, if any degree, superior, to that which

produces the grey moss. The species of grass I mean, is very different from that known by the appellation of bent, which grows in the sand near the sea-shore. The sort here alluded to is much narrower in the leaf than the other, and grows in circular knots or patches. This species of bent is scarcely ever found by itself, but is generally intermixed with heath and other plants. It denotes a stiff, poor soil, inclined to wet; and where it abounds, we should scarce plant any thing but the alder, wild willow, and spruce intermixed with a few birches. Even these hardy sorts will be far from reaching maturity in such a soil.

Dry land, in which the heath is thick and healthy, and contains no mixture either of the above mentioned grey moss or benty grass, is capable of producing a good average crop of larch, birch, and Scots firs: oaks likewise may be planted in it with success; but it is too poor for the ash, elm, beech, or plane. If the heath be here and there intermixed with the plant that bears what, in Scotland, is called the *blae* or blue berry, the English Bilberry, or with thriving juniper bushes, the land may be deemed still more favourable to the growth of the larch and Scots fir, than when the heath, though healthy and vigorous, occurs alone.

When stout plants of the common broom grow abundantly among thriving heath, they furnish an unequivocal criterion of superior fertility. In land that produces this plant, we may expect the larch and the Scots fir to attain a very large size. We may also plant in it the oak, if it is situate on a declivity, and in addition to these, the beech, if it lies in a hollow or ravine, with every prospect of success.

Furze or *whin* is a much less unequivocal indication of the qualities of soil than any of the plants we have yet mentioned. It springs up on the best as well as the worst of soils, and it is rather from its size than its mere presence that we can draw any conclusion as to the quality of the land where we find it. When it is dwarfish, and has no large stems or branches, although it be, at the same time, green and healthy, we may take it for granted that the soil is very poor; but if, on the contrary, the stems are large and gigantic, they indicate a quality of land not inferior to that which produces broom. Furze, however, is on the whole a very uncertain criterion by which to judge of soils.

Wherever we find any of the species of fern or *braken* in pretty large quantities, we may safely conclude that the soil is of the most fertile quality of any

that is to be met with in an uncultivated state. The fern indicates a considerable depth of vegetable mould *, of a quality that may be turned to good account in the production of corn; and it is merely from the insulated situation of the spots which produce this plant, in our waste land, and their being surrounded by large tracts of barren moor, like small isles in the middle of the ocean, that they have not long since been brought under the dominion of the plough. In planting, no opportunity should be lost of turning such patches to account, by filling them with the most valuable kinds of wood. When ferns grow on declivities and pretty elevated spots, we should plant, as the principal crop, the oak, plane, or beech; when in glens or hollows, not only these three varieties may be planted, but likewise the ash and elm, both of which will, in such situations, attain a very large size; and if we are studious of variety, we may add the Spanish chesnut.

* That is, in glens and hollows; for on elevated spots the fern is frequently found where there is no great depth of vegetable mould. This plant always denotes, however, that the mould, *however* shallow, is of a good quality, and that the subsoil is of a friendly nature.

On the banks of rivulets where the kinds of grass deemed best for pasturage are abundant, the land may be considered as extremely well adapted for the ash and elm. In such situations likewise, the oak will grow to a large size, as well as the poplars and finer species of willows, if they are planted near the brink of the stream.

The above remarks relate chiefly to dry soils, as most of the plants enumerated, with the exception of the heath and benty grass, are found in such soils only. It is scarcely necessary to have recourse to a similar mode of ascertaining the quality of wet land. There are few of our wastes that require draining, which will answer with the more delicate species of aquatic trees, in which class may be comprehended the poplars and foreign species of willows. These will prosper on the strips of meadows, that are sometimes to be met with on the banks of our solitary streams, but they will come to nothing in a peat moss or a quagmire, resting on a bottom of till. Wherever we find a great quantity of moisture, therefore, we should plant those kinds of aquatic trees, and those only, which are either natives of the country, or, having been introduced from northern climates, have been long naturalized in it. For bogs and marshes, which it is impracti-

cable to drain, the alder and the indigenous species of willows are the proper kinds. Where the surface water can be got clear of, the spruce and silver fir intermixed with birches, and here and there a larch, will be found to answer best. These may indeed be considered as the most profitable for wet land, whether the soil be good or bad.

I may notice here, though the remark would have more properly appeared in the preceding chapter, that there are many mineral productions which are unfavourable to the growth of timber. To say nothing of iron and lead ore, the latter of which, especially, is well known to be unfriendly to vegetation in general, few kinds of trees will grow freely where slate abounds. An exemplification of this remark may be seen near the slate quarries, in the Parish of Culsalmond, Aberdeenshire. Freestone especially, when it lies near the surface, is likewise inimical to the production of wood. The same is perhaps true of most of the minerals that occur in Scotland, with the exception of limestone, whinstone, and granite; terms which, as they are commonly used, comprehend a number of rocks, to which mineralogists give other names,

CHAPTER VI.

PLANTING OF WASTE LAND.

SECTION I.

PREPARATION OF THE GROUND FOR THE RECEPTION OF THE PLANTS.

THE next subject that comes under consideration is the planting of waste land; but as this will embrace a variety of topics, each of which will require to be explained at some length, the best way of proceeding in order to prevent confusion, will be to treat them seperately, ranging each under a head by itself. I begin with the preparation of the ground for the reception of the plants.

One of the most indispensable preliminaries to planting any piece of waste land, is properly to enclose it; for if a young plantation be left exposed to the inroads of sheep or cattle of any kind, it will be in vain to expect it to prosper. Fences, in this country, are generally constructed of stones or of

turf, and, in some instances, though more rarely, of paling. When stones can be procured, and this can easily be done in most of the waste lands in Scotland, without even the expense of quarrying, they are by far the best materials for an enclosure. Turf may be considerably cheaper in the first instance, but it makes a much less durable fence, and is not so efficient even while it continues in repair. Paling may be constructed in such a manner as to be cheaper at the outset than either turf or stones, if a proprietor has young plantations in need of thinning, capable of furnishing spars large enough for the purpose. But this kind of fence is liable to be broken down by cattle rubbing themselves upon it, and a variety of other accidents, which keep it almost in continual need of repair; and it is, besides, but temporary, as it soon rots and falls to pieces.

A stone or turf enclosure may be built either in the form of a common dike, or in that of a sunk fence, having a ditch running along, and close to its perpendicular side. The latter form is only to be recommended where materials are scarce, for though it is less expensive at first, it comes sooner to need repairs than a common dike, and is on the whole not so good a fence.

In districts where there are no sheep, fences will

not require to be more than four feet, or four feet and a-half high: but where these animals abound, especially any of the Scotch breeds; five feet, independent of the coping, will be requisite. Instead of being built perpendicular or plumb, as it is termed, dikes of all descriptions should be wider at the base than at the top: so that they may slope considerably on each side, and that their centre of gravity may be as near the ground as possible. This is essential to their stability, for being without any kind of cement to bind their materials together, they will, if built perpendicularly, bulge out and soon fall to pieces. When the stones are of a convenient size, they should be built in regular courses; the stones of every succeeding course being so laid, that each may rest upon two of those below, as in masonry. The heart of the dike must be well packed, otherwise the stones will fall inwards in the course of a few years, and all will go to ruin. The top should be either coped with turf, or with a row of stones, each large enough to take in the whole, or nearly the whole, breadth of the dike. The latter method is the more eligible, as it affords less secure footing to man or beast, that may be inclined to trespass, than turf does. The best builders of stone-dikes are to be found in the parts of the country where this

kind of fence is most prevalent, and contractors from these should of course be preferred. The best dikers in the north of Scotland are perhaps those of the middle district of Marr, in Aberdeenshire. The most famed in the south are those of Galloway, who practise a peculiar kind of coping, which is in great repute.

The cheapest way of constructing a paling, is to drive upright posts into the ground, and nail spars to them horizontally. This is the only mode of forming paling, in fact, which will be found less expensive, even at the first outset, than a stone-dike. The upright posts should not be made farther asunder than six or eight feet; and the horizontal spars not more than one foot; and four rows of them will be required in order to defend sheep.

In wet land, another indispensable preliminary to planting is ditching, for no kind of trees will thrive, not even the most aquatic species, where water either stagnates, or runs above the surface. To make ditching effective, the nature of the ground must be well considered, as different modes of proceeding become necessary as this varies. When the soil is of a light quality, and soft enough to let the water filtrate easily, one ditch of proper dimensions, and rightly situated, will dry a considerable extent of

ground. On the contrary, when the land is of a stiff sour quality, the moisture is much more difficult to drain off, and the effect of one ditch will be comparatively trifling. Perhaps the most economical way of draining such lands, is to make one ditch (or more if necessary) of a considerable size, and to connect a number of smaller ones with it, as branches. Where wetness is occasioned by a substratum so hard as to be impervious to water, it will serve no useful purpose to go deeper, in making ditches, than the level of such substratum, however little it may be below the surface. Shallow land incumbent on a bottom of this kind, may therefore be made as dry as it is susceptible of being, by dividing it into ridges of from twelve to twenty-four feet wide, with ditches of the size of furrows between them. Sometimes the wetness of the land proceeds from the moisture which runs from the more elevated ground contiguous to it. When this is the case, the best method of drying it will be to run a ditch between it and the latter. The bottom of this ditch should be somewhat below the level of the lowest part of the ground intended to be dried. If the latter slopes considerably, however, a single ditch, to answer this description, would require to be sunk to an impracticable deepness, and it will

therefore be necessary to make several parallel ones, at such distances, that the top of the second may be on a level with the bottom of the first, and so on; and that the bottom of the last may be lower than the least elevated part of the ground. Sometimes a considerable extent of ground is rendered wet by a spring, in which case the fountain-head should be carefully ascertained, and a ditch of sufficient capacity to carry off the water which it throws out, made from it, in the most convenient direction. It is almost unnecessary to observe, that ditching or draining of any kind presupposes a proper declivity for carrying off the water, and where this is wanting, the drying of ground is hopeless.

In making ditches, the earth thrown out should be thrown to some distance from the edge, and the bottom should be left entirely free of any inequalities. The sides should slope considerably, otherwise fragments of them will be continually falling down, and filling up the channel. Water runs quickest, and does least injury, to the banks that confine it, when it has a straight course. A ditch, therefore, will best answer its intended purpose, and continue longest in repair, when it is free of crooks and angles. It is in consequence generally better to form several straight ditches, than to endeavour to

make one serve the purpose of all, by carrying it in a crooked or zigzag direction. Sometimes, however, it will happen, from the shape of the ground, or some other circumstance, that a crooked ditch is the only one which will answer. When this is the case, the turns should be made round instead of angular, and as gradual and easy as possible. When one ditch opens into another, the corners formed by their junction should also be rounded. It is hardly necessary to add to these remarks, that however well ditches be made at first, they will occasionally require to be scoured and repaired.

Waste land is generally covered with heath, furze, or broom, and these are often in such a state of luxuriance, as to render it necessary to clear them away before proceeding to plant, otherwise the least expensive way of performing that work will be precluded. The easiest mode of clearing away heath is to burn it. This should be done in autumn, or early in spring, and at least three years before we intend to begin planting. This interval is necessary, in order that the surface of the ground may be again covered with vegetation. I have never seen young trees succeed well, when planted while the surface was entirely bare from the effects of burning. The reason seems to be, that the ground is then in

a blown or loose state, and admits both the frost and drought much too freely. Heath should not be burnt when it does not exceed four inches in height, as, in this state, it will not impede the planting of the smallest plants that are ever removed from the nursery. At the greatest length it attains, it does not injure the plants themselves, but merely renders the fixing of them a matter of greater difficulty than is desirable, or than can sometimes be overcome, even by the most expert workmen.

Furze and broom are more difficult to get rid of than heath. They may, indeed, be burnt as easily as the latter, but their roots remaining in the ground render it boss or hollow, a state in which the drought gains so easy admission, as to make it impossible for any thing planted in such a situation to grow, or even to survive. Instead of being burnt, therefore, as has been recommended with regard to heath, it is necessary that furze as well as broom be carefully rooted up. These remarks, however, are to be understood as applicable only when very small plants are to be used. There are cases, as we will afterwards have occasion to notice, in which it is advantageous to let furze and broom remain as we find them.

Wherever heath grows plentifully, the surface

when pared off, and properly dried, is susceptible of being burnt, and some recommend paring and burning as a good preparation of land about to be planted. This practice, however, except where there is a considerable depth of peat-moss, is not merely useless but pernicious. Its advocates ground their support of it on the ashes which it produces; but, with the exception already mentioned, they are wholly insignificant in quantity, while the burning evaporates a great part of the real strength of the land. In peat-moss, however, where a sod of several inches thick may be taken off without laying bare the subsoil, paring and burning may be resorted to with advantage. Land of this kind in the natural state, is found to agree very indifferently with most kinds of wood. The cause seems to be, that its vegetative power lies dormant, and requires the application of some stimulant to restore its activity. Now, the ashes created by burning the surface are found to be such a stimulant; for without the addition of any other manure, we often see them render mossy land capable of producing a good crop of corn, and it is reasonable to conclude, that they will have the same beneficial effect in communicating the energy which is requisite for the growth of trees.

Paring is performed with a spade made for the

purpose, having a very long handle. The best time for executing the work is from March to the end of August, the season at which the drought is generally most intense. The sods will dry most quickly, if they are set on their edges, three and three together, so as to support each other. When they are dry enough for burning, they should be collected in pretty large parcels, and piled up in such a manner that the wind and air may have free access. This is essential to their being quickly consumed.

Some writers recommend much more expensive modes of preparation than any which I have here proposed, such, for instance, as ploughing or trenching the ground. As to ploughing in rough stony land, that has never undergone the operation before, were it always practicable, I know of no purpose that it can serve, but to render the surface more uneven than it was in its primitive state, and increase the difficulty of planting. Trenching, when applied to barren ground as a preparation for wood, is of very doubtful utility *, and were its advantages certain,

* By this, it is not meant that trenching of barren land may not accelerate, in a considerable degree, the growth of the trees planted on it. But with regard to firs especially, it may be doubted, whether any advantage can be gained by such acceleration, that is not more than counterbalanced by the timber being deteriorated in quality by this means.

the expense of it would preclude its coming into general use. Those who advise the adoption of such a plan, are generally persons whose knowledge is purely theoretical. Though unintentionally, they do real injury to the interests of planting, by persuading their readers that it is a kind of improvement much more costly than it actually is, when conducted on rational principles.

SECTION II.

ON THE AGE WHICH THE DIFFERENT KINDS OF TREES OUGHT TO BE WHEN THEY ARE REMOVED FROM THE NURSERY TO WASTE LAND—DESCRIPTION OF VARIOUS METHODS OF PLANTING.

THE most proper time for removing Firs from the nursery to waste land, is when they are two years old. Larches, indeed, may often be successfully transported at half this age, as they grow more in the seed-bed during their first summer than any other species of the same tribe; but the Scots, spruce, silver and balm of Gilead firs make so little progress the year they rise from the seed, as to render the planting of them, if not absolutely impracticable, at least so difficult an operation, that few

workmen will be found, possessing both the dexterity and patience to perform it in such a manner as is necessary for the welfare of the plants.

Formerly it was customary, in making plantations of firs, to use plants of an age much superior to that above mentioned, and a practice, which was once universal, is, in many districts, still common. As the expense of planting increases with the size of the plants, it is reasonable to conclude, that the practice in question originated in an opinion, that it was better calculated for securing the growth of the trees, than any more economical plan; and some feeling of a similar kind must be the reason why it is adhered to in the places where it yet prevails. But such an opinion, however generally it may have once been entertained, and however firmly it may, in certain districts, still keep up its ground, I have no hesitation in affirming to be completely erroneous. The experience I have had enables me to say, with as much confidence as I can speak on any point whatever, that the longer any fir is allowed to remain in the nursery, after it has attained two years' growth, so much the less chance is there of its success, when removed to its final destination. The roots of a fir become the more woody and destitute of small fibres as it advances in years,

till, at length, these fibres entirely disappear; and when this takes place, no tree of any kind can be removed without endangering its life. An ash, an elm, or a birch, may be transplanted with safety, when it is eight or ten years old, or with careful management, even after it has arrived at its full growth; and the reason is, that its roots are well provided with small fibres, at every period of its age. But transplant larches, Scots firs, or any other species of the same family, after they have stood only six or seven years in the nursery, and one-half of them will infallibly perish. Let them be removed at ten years old, and scarce one in a hundred will survive. The spruce and the silver retain their small fibres longer than the rest, and they, of course, may be removed with less comparative danger at a greater age than any of the other kinds; but with regard to the whole race, the assertion already made will be found true; namely, that the safest time for transferring them from the nursery to waste land is, when they are two years old, and that the danger of removal, after this period, increases regularly with their age. If any reader is inclined to doubt this, I would recommend to his notice the following simple experiment:—Take an equal number of firs of any kind, but of different ages, two years being the

youngest; let them be as nearly as possible equal in healthiness; put them into any piece of waste land where the soil is adapted for the particular species on which the experiment is tried, and give them equal justice in planting. The result, at the end of two or three seasons, will be such as to convince the most sceptical of the truth of what has been just advanced. Such an experiment may, at a very moderate expense, be made to comprehend every variety of the fir tribe.

Both economy, at the first outset, therefore, and the success of the plantation afterwards, determine that the proper time for transporting firs from the nursery is, when they are in their second year. At this period, larches may be obtained transplanted, as it is customary to put considerable numbers of them out into nursery lines, when they are one year old. Such plants have generally better roots than those that have remained in the seed-bed till they are of the same age; but as their price is considerably higher than that of the latter, it is somewhat doubtful whether they are so much superior in quality as to compensate for the greater expense which attends the use of them. At all events, healthy larches from the seed-bed have never failed to give satisfaction when put into soil suitable for them, re-

ceiving, at the same time, due justice in planting. With regard to the other species of firs, they are scarce ever transplanted in the nursery, till they are two years old, so that, in purchasing them of this age, there is no choice left but to take them from the seed-bed.

Besides the fir tribes, there are two or three other varieties of trees which are found to succeed well in waste land, when removed to it from the nursery in their second year. These are the birch, alder, and mountain-ash. The last mentioned of the three, indeed, generally attains a size in one year which qualifies it for being transplanted to the most barren situations, as successfully as at any period whatever.

As soon as it was known that firs, and the other species just mentioned, might be successfully transported to the moors, at the above stated age, it was natural that a similar attempt should be made with that important class which comprehends the ash, elm, beech, plane, and oak. But, to say nothing of the last mentioned tree, the proper mode of cultivating, which is explained at another place, I have never known this experiment answer well with the other four species, though I have seen it tried in a variety of instances, to a considerable extent, and in

land of a quality perfectly congenial to the nature of the trees.

Here it may be expected that some reasons should be assigned why a result so different ensues in the case of the species in question, from what has been stated as taking place when firs are concerned. But this mystery I confess myself unable to clear up. The difficulty is rendered the more hard of solution, from the fact, that all the deciduous trees above mentioned, with the exception of the oak, which is averse to removal under any circumstances, may be transplanted in thousands and tens of thousands in the nursery, without almost a single failure, at the same age at which, if they are transported to waste land, three-fourths of them will perish. The knowledge of the fact, however unable though we be to account for it, is sufficient to direct us in practice; and plainly warns us, in forming plantations of ash, elm, planetree, and beech, to make use of such plants only as have stood some time (two years at the least), in nursery lines, after having been removed from the seed-bed.

Willows, poplars, and other trees which are propagated by layers and cuttings, may be removed from the nursery as soon as they are sufficiently

rooted, which, in general, they will be, in a year after the slips and layers are put into the ground.

The above remarks embrace all that I have to offer respecting the ages at which the different kinds of trees ought to be transferred to the situations where they are intended finally to remain. I proceed next to describe the several varieties of the mechanical part of planting in most common use; and, in doing this, I will have an opportunity of pointing out the cases in which each may be most successfully applied.

The oldest, and most generally known, system of planting adopted in forming woodlands, is that which has received the technical denomination of *pitting*. It may be described as follows:—A sufficient number of round holes or pits are made in the ground intended to be planted, at regular distances from one another, and each large enough to contain the roots of a single plant, when extended at their full length. The earth taken out in digging the pit is laid upon its edge, care being taken neither to tread upon nor scatter it. In putting in the young trees, two persons are generally employed. One sets a plant in the pit, in such a position as that the central part of the root may coincide

with the middle of the latter, holding it perpendicular by the top, while the other shovels in the earth till the hole be filled, and the roots sufficiently covered. The earth is then trodden down with the foot to make the plant firm in its position, and in this way the work proceeds till the whole is completed.

Sometimes one person undertakes the whole operation, and, in that case, he uses a cross made of two small sticks, which instrument is laid on the mouth of the pit to keep the plant in an erect posture, while the earth is put upon its roots. This substitution of a stick for a man is not, however, to be recommended but in cases of absolute necessity, as it performs its part in a very indifferent manner. Nor do its services save much; for though it is an assistant that demands no wages, it is at the same time so awkward as materially to impede its living coadjutor in the performance of *his* part of the work.

The perfection of this system of planting consists in setting the plant perpendicular, in giving its roots sufficient space to be straight and at full length, and in properly fixing them. Bruised roots should be cut off, and straggling ones shortened, previous to planting. But that absurd method of proceed-

ing which ignorant or careless workmen sometimes adopt, of pruning the roots till they get them to fit a too narrow hole, should be strictly prohibited. Nothing is more apt to kill a plant than the pruning of its roots too closely. When a pit is found too small to contain them, it should be enlarged to the necessary size, but on no pretence whatever ought *they* to be reduced in order to suit *its* dimensions.

The pitting system should be adopted in every instance in which the plants exceed two years old; and no other method should, of course, be ever resorted to when we have to do with the ash, elm, planetree, and beech.

The expense of planting was much reduced by the introduction, about a century ago, of the notching system. Of this there are now two varieties, the oldest of which may be described as follows:

One person makes a notch in the ground, or rather two notches crossing each other, with a common spade, raising the sod by bending down the handle of the instrument, till the notch becomes wide enough to receive the roots of the plant. An assistant, who attends with a bundle of young trees, singles out one of them, and slips its root into the aperture thus made for its reception. The spade is

then withdrawn, and the natural elasticity of the sod causes the edges of the notch to approach each other,—a tendency which is assisted by a smart stroke from the heel of the planter, and this fixes the plant. In this way, two persons well practised in the work, will put into the ground between five hundred and a thousand plants per day.

This system was much simplified about fifty years ago, and rendered so expeditious, that it seems in vain to look for its receiving any further improvement. Instead of the spade, an instrument of nearly the same shape, but so small that it can be wrought with one hand as easily as a common garden-dibber, was introduced, and is now known by the name of the Planting-iron. With this a notch is made in the ground to receive the root, and, owing to the portability of the tool, and its occupying but one of the hands, the person that works it requires no assistance, but, carrying a parcel of plants in a wallet before him, he singles out one with his left hand, inserts it in the notch, withdraws the implement, fixes the plant with his heel, and proceeds with as much apparent ease as if he were performing the operation in the soft ground of the nursery. In this way of planting, the workman goes forward in such a line as he can judge

of by his eye, and as it is extremely difficult to see the plants after they are put in, especially if the heath is pretty long, he sets up poles in the first line, to enable him to keep the second a due distance from it; and, in planting the last mentioned, he removes these poles into it, as he comes opposite to them, which then serve as his guide in planting the third; and thus he proceeds till he cover the whole of the ground. Instead of poles, the simpler expedient is sometimes adopted, of cutting up small sods here and there with the planting-iron, and laying them on the tops of the heath, and they answer the same purpose, though in a less perfect manner. The lines thus formed are necessarily so zig-zag, that, when the trees grow up, they do not seem to have been planted in rows of any kind.

In this way, an expert workman will plant between three and four thousand young plants a day, and do it so perfectly, that the fault will not be his if a single individual of the whole number fail to grow. This method, therefore, is, at least, six or seven times cheaper than the original form in which the notching system was introduced, and, in fact, renders planting as economical a process as it seems possible to make it. When a person sees it prac-

tised for the first time, the expedition with which it is performed never fails to astonish him; and the apparent slovenliness of the operation is as sure to prejudice him against it. There is so little of that care exercised, which he had previously supposed to be necessary, in order to make a tree grow, that he regards the whole process with contempt, and is disposed to wonder at the stupidity of those who hope to rear wood by means which, in his estimation, are so unspeakably absurd. The strongest prejudice, however, gives way on observing the effects of the system. I have assisted in planting, according to this plan, upwards of three thousand acres in Aberdeenshire alone, and, in all that extent, I know not of a single instance of failure, where the plants were in a healthy state when put into the ground, of the proper age and varieties, and suitable for the soil where they were planted.

I am the more anxious to draw attention to this method, as there are many districts where it is yet entirely unknown; and should these remarks be instrumental in bringing it into general use, though it were but a few years sooner than it would otherwise be, I shall have the pleasure of regarding them as having promoted, in no small degree, the interests of planting.

"Let not the reader, however, mistake my meaning. This system is by no means of universal application. It can only be adopted with propriety when the plants do not exceed two years old. To apply it to those of a greater age, will, in every instance, be attended with disappointment, as it is impossible to make a notch of a sufficient size to contain a large root, without either pruning it too closely, or doubling its fibres, both of which are inconsistent with the free growth of any plant. The use of the system must, therefore, be restricted to the fir tribes and the other species enumerated above, which may be successfully removed from the nursery at the age of two years.

To plant well and expeditiously, in this way, requires considerable dexterity on the part of the workman; and, where raw hands are employed, it will be necessary to have some person to teach and superintend them, otherwise their performance will be far from giving satisfaction. Those who have been previously accustomed to work in the nursery will soon become masters of the process; but others will require longer time, and more careful instruction. A learner should be taught to put the plants into the notch without doubling their roots, to fix them properly, and to take care not to strip off their bark with the planting-iron.

The plants may have the extremities of their fibres shortened a little with a very sharp knife, but the greatest care must be taken not to touch the woody part of the roots.

SECTION III.

SEASON OF PLANTING—DISTANCES AND ORDER OF THE PLANTS—ROADS IN PLANTATIONS.

The most general opinion seems to be, that it is better to plant in autumn than in spring. When the land is naturally dry, and has a good cover on its surface, this opinion is no doubt correct. But in wet and swampy soils, as well as in land, whether moist or dry, whose surface is bare, I would be inclined to prefer the spring. Wet land swells with the frost to such a degree, that plants which have not had time to take a firm hold with their roots, are almost inevitably thrown out. This effect often takes place, as well in the nursery as in newly formed plantations; and it is one that requires to be sedulously guarded against, as it not only renders the labour of planting abortive, but destroys the plants themselves. Dry ground, as has already

been remarked, is liable to the same inconvenience, if the surface be destitute of cover. When, therefore, we have to do with land possessing either of these characteristics, it is best to defer planting till the month of February, a season at which the strength of the frost may be presumed to be over; and, before next winter, the young trees will have fixed their roots so firmly as to be out of danger. It is, however, proper to state, that these remarks have reference to the method of planting last described in the preceding section, and to it only. When the pitting system is adopted, it fixes the plants so thoroughly, as to render the utmost power of frost incapable of doing them any injury.

Autumnal planting must not commence till the wood of the plant be fully ripened; and spring planting must not be carried on after the buds begin to swell. The utmost limits of the planting season may, therefore, be estimated from the middle of October to the middle of March. In backward autumns, it will not be advisable to begin operations earlier than the first of November, nor to continue them, in forward springs, later than the end of February.

With regard to the distance from one another at which trees should be planted, there are various opinions. In most places of Scotland, it is customary

to put from three to four thousand into the acre. Of this number, a great part require to be thinned out at an after period, in order that the rest may have room to come to maturity. Such crowded planting has, therefore, been censured, as a source of needless expense and labour; and to those who take a superficial view of the matter, the practice must no doubt appear sufficiently absurd. People, however, who have more carefully considered the subject, see it in a very different light. When trees are exposed to the full rigour of every blast and hurricane, they are generally, even at their best, crooked, unsightly, and dwarfish; or they, at least, possess these undesirable qualities in a far greater degree, than when they enjoy protection from the violence of the winds. Even the comparatively insignificant size which they attain, is acquired by extremely slow degrees. To prove these assertions, it is only necessary to instance the case of trees which stand solitary, and of those placed in hedge-rows or in belts, all of which are universally found to be inferior to such as are in precisely the same circumstances, with the single exception, that they grow in extensive woods or forests. No reason can be assigned for this difference, but that the latter have,

by their situation, the advantage of shelter, while the former are destitute of it.

If shelter, then, has so great influence in promoting the growth of trees, we have a very strong reason for planting them much nearer to one another than they will require to stand when they reach their full maturity; for the closer we plant them, the sooner, it is evident, will they be in a capacity to defend each other from the winds. If they be placed only four or five feet asunder, the quicker growing kinds will be tall enough, in the course of five or six years, to screen each other from the weather, as effectually as if each of them were surrounded by a stone and lime wall; whereas, if we put twelve, sixteen, or twenty feet between them, they must remain exposed, and in consequence be greatly retarded in growth for a much longer period, or probably become so stunted and hide-bound as never to grow freely afterwards. I have observed it generally to hold good, that the plantations which grow most quickly, are those which stand in need of thinning by the time they are eight or ten years old; and I do not recollect a single instance of young trees being in a thriving state where they were straggling and far asunder. I am, therefore, a decided advocate for thick planting, and would ad-

vise that not fewer than three thousand trees per acre be planted in good land, nor a less number than four thousand, when the soil is of a middling or inferior quality.

When, however, we intend any of the deciduous species, which require to remain in the nursery till they are of a size that render their price high, and the expense of planting them considerable, to be the principal crop, it would be the height of folly to place them nearer to one another than the distances they may be supposed to require when they have arrived at their full size. They should be planted from sixteen to twenty-five or thirty feet asunder, according to the richness of the soil; and as many firs planted among them, by way of nurses, as will make the whole of the above mentioned thickness. This so obvious method of saving expense is often unaccountably neglected.

On the order of the plants little need be said. It was formerly the custom to place them in straight lines, and a most absurd custom it was, as it gave the wind a thoroughfare between every two rows of trees; so that the centre of the plantation was as shelterless as the open plain. The effect on the eye which a wood, planted on this principle, had when it grew up, was in the highest degree formal and

unpleasant. In fir plantations, this was particularly the case: as from the stiff regular shape of the tops of this kind of trees, their ranks were as well defined at every period of their age as the rows of a plot of newly planted cabbages in a kitchen garden. The absurdity in question is now, however, universally exploded: and it would be fighting a shadow to say any thing farther in its discommendation. In planting according to the method last described in the preceding chapter, the workmen proceed in lines: but these, as was there observed, are necessarily so crooked and zig-zag, as to be quite undiscernible when the trees grow up.

Much inconvenience is often experienced in large plantations from the want of roads. When an extensive wood comes to require thinning, it is always a work of extreme difficulty, sometimes of absolute impossibility, for want of an open path, to get the trees which are cut down carried from the interior to the outside: and they are, on this account, often left to rot where they fall, by which means no advantage at all can be derived from them. It often happens, too, when a wood is full grown, that those trees which it would be most advisable to bring first to market, are situate not in or near the external parts, but at the very centre; in which case the

want of ready access must be severely felt. Were there no other advantage to be derived from roads, than the facility with which a plantation can, at any time, be examined, and its state ascertained by means of them, their utility would be manifest, and to omit putting the reader in mind of them unpardonable. The pleasure, too, that may be received from them, as walks, or rides, when the state of the weather is such as to demand either shelter or shade, is no contemptible argument in their favour; and, without them, it is indeed impossible to have the full enjoyment of forest scenery.

Roads in plantations ought to be contrived in such a manner as to afford as easy access as possible to every part. They should never be made straight, as, in that form, they would present a thoroughfare to the wind, than which there are few evils that should be more carefully avoided. The line of a road should be marked off, or rather the road itself should be fully formed, before we proceed to plant. The best way of performing the work will be to make a ditch on each side of the space intended for the road, the inequalities of which should be levelled with the earth, or gravel taken out of the ditches. Thus the two chief requisites of dryness and smoothness will be acquired at a very trifling expense. A

road of this kind should be of a breadth sufficient to allow two carriages or loaded carts to pass each other; and no boggy places, or steep ascents, should occur in the line of it. In plantations of a moderate size, one road may be made to wind so as to serve every purpose of accommodation. In more extensive ones, it may become necessary to connect branches here and there with the principal line, to lay open a communication with the parts which it cannot be made to approach but by giving it more of the serpentine form than can be done without occupying too much ground.

SECTION IV.

SUPPLEMENTARY REMARKS.—SHELTER FOR DECIDUOUS TREES, &c.

In addition to what has been said on the subject of Planting in the preceding sections, the following miscellaneous observations are submitted to the consideration of the reader.

Allusion has already been made to the advantages which every species of trees derive from shelter, and

thick planting has been recommended as a mean of attaining it as early as possible. This contrivance, if it deserves the name, is the only one that can be had recourse to, in the case of firs, as there is no other species that can, with propriety, be interposed between them and the blast, they being themselves the hardiest and quickest growing trees we possess. In raising deciduous trees, however, circumstances are different, and instead of leaving them unprotected till their own advancement in growth qualify them for turning aside the force of the wind from one another, we may easily have shelter in readiness before we plant them.

In a foregoing section, the propriety of planting firs as nurses among deciduous trees was pointed out. Such a practice is attended with a great saving, as it precludes the necessity of planting more of the latter in any given extent of ground, than may be supposed capable of filling it, so as to leave no spare room when they have attained their full size. Instead, however, of putting nurses and nurselings into the ground at the same time, as is commonly done, it is much better to plant the one several years before the other. The firs will, by that time, have grown to the height of from three to six feet, and will be in a capacity to protect effectually from the

injuries of the weather any plants less than themselves that may be introduced among them.

It may seem that, by adopting this plan, several years' growth of the deciduous trees will be lost, but it is not so in reality. A great advantage to be derived from proceeding in this manner is, that the deciduous trees are preserved from the danger of becoming hide-bound, which they are very apt to do on being removed from the nursery into exposed and cold situations. When this disease attacks trees, they are long before they recover the shock, and often die entirely, so that every practicable method of preventing it should be sedulously employed. But for a fuller account of the utility of sheltering trees from the time they are planted, the reader is referred to the part of the work which treats of the cultivation of oak. All the remarks on the subject there offered, are applicable to the elm, beech, and all the more valuable varieties of the deciduous kind, as well as to the oak itself.

Broom and furze of a considerable height afford ready shelter for deciduous trees. In planting them, however, in such situations, the following rules must be observed:—*First*, The pits should be made at least three times as large as in open ground, that the roots of the furze or broom may be kept at a

proper distance. And, *secondly*, We must plant considerably thicker than when firs are the nurses, because the young trees must depend on one another for shelter, after they attain the height of five or six feet.

In many parts of Scotland, planting by contract is much in use. Nurserymen are the persons who generally undertake jobs of this kind, and they engage to furnish the plants, and put them into the ground, at a certain sum per acre. In making such bargains, the age of the plants, their varieties, the distances between them, and the number of each kind to be used, are specified; and the contractor, for the most part, engages to uphold his work for a certain number of years; that is, to put in fresh plants in all the deficiencies that may occur during the stipulated period. This last condition is the best security that can be taken for the works being properly executed at first.

Planting by contract will, in general, be found the most economical plan of any, in propagating those species which answer with that variety of the notching or slitting system last described, in the preceding section but one. The reason is, that nurserymen have always at command a number of hands, who are either already expert at this mode of

planting, or whose previous employment has been such, that a little practice will give them the requisite dexterity. But it is, in most instances, far different with the proprietor of the land. He, in general, can obtain no workmen but such as are completely untaught, and for whom an instructor or overseer must be procured probably with great difficulty, and at very high wages. What is worse, unless the ground to be planted be very extensive, the workmen will not have acquired facility in the execution of the work when the job is completed, so that the whole of it will be performed with a slowness which will greatly enhance the cost. Hence, proprietors may, in general, contract with nurserymen for planting on this system, at less than two-thirds of the expense at which they could perform it themselves. This at least is the case in several of the northern counties.

But when the trees are of those kinds that require the pitting, instead of the notching system, no advantage at all will be derived from treating with nurserymen on the above-mentioned plan. Any man that can handle a spade and mattock is qualified to make pits, and abundance of such men are every where to be found. The putting in of the plants is an operation which must be carefully per-

formed; but it is so simple that it may be learned with the utmost ease; and any person who is qualified to manage the most ordinary kitchen garden will be able to superintend the work. The cheapest way of making the pits will be to slump them with common labourers at so much per hundred; but the putting in of the plants should be always a day job, and executed under the inspection of a gardener, forester, or some other person whose skill and carefulness can be depended on.

Those who plant extensively, and have nurseries of their own, as they will always require to have several men in constant employment under a forester, can easily have them trained so as to be capable of planting on any system. The remarks contained in the last paragraph but one, therefore, are only applicable in cases where operations are intended to be carried on, on a comparatively small scale, and to be concluded in a few years.

Thus have I laid before the reader all the information I have been able to derive from experience, relative to the planting of every species of trees which are adapted for our Waste Lands, with the exception of the Oak, whose culture is treated of by itself in another part of the work. By proceeding according

to the methods I have described, 4000 two year old firs, the greatest number that is ever put into a Scots acre, may be put into the ground, including the price of plants, at twenty, or sometimes as low as fifteen shillings. At this rate, the planting of several thousands of acres, an extent which would make a very respectable forest, is within the compass even of a moderate fortune. Most of the deciduous and hard wooded species of trees,—as they ought to be transplanted in the nursery, and to remain there till they are at least four years old, and as they require the pitting, instead of the notching system of planting to be adopted, in placing them where they are intended to grow up into timber,—will be found considerably dearer in cultivation than firs. Yet by using the latter as nurses, and planting no more of the hard-wooded kinds than will have room to come to maturity, plantations of them may be formed as low as fifty shillings or three pounds per Scots acre. This at least can be done in the northern counties, and I am aware of no reason why it should not likewise be possible in the south.

With regard to the mechanical part of planting, other methods might have been described of which I have taken no notice. Of the three plans I have mentioned, the first and the last are sufficient for

every purpose,—the one being requisite for large—the other, the cheapest and most expeditious ever invented for small plants. As to the method which stands in the second place, though it was a considerable improvement when first introduced, it has no advantage which is not possessed by the method last described, while it is much more expensive, unless that it may be learned with rather greater facility than the other by beginners. Some, indeed, consider it as proper to be applied in the case of such plants as I have recommended to be treated on the pitting system; but this is a grossly mistaken notion, and the sooner it is exploded the better.

CHAPTER VII.

MANAGEMENT OF WOODS.

SECTION I.

PRUNING.

MOST deciduous trees, if left to themselves, have a tendency to grow with short trunks, containing little timber, and to waste their strength in the production of large unwieldy tops. This tendency it is the office of pruning to correct; and that process, when timeously and judiciously applied, has a most salutary effect in increasing the quantity of measurable timber in a tree, and consequently its value, when brought to market. Some kinds of trees, however, there are, which, instead of receiving benefit from pruning, suffer injury from it; and it will be proper to particularize these, before we proceed to give directions for its application, in the cases where it may be practised with advantage.

The species that do not admit of this process are all the firs, including the larch, or, at least, all of them, that are commonly cultivated in this country.

I am aware that my sentiments on this head differ from those of several writers of respectability, and, particularly, from those of Mr PONTEY. "It is impossible not to smile," says that author, "at the absurdity of writers, who either tell us not to prune firs at all, or not to do so till the branches show evident marks of decay; as a little of that much neglected article, experience, would teach them, or any others, that if a branch were cut off while alive, the sap-vessels would send out resinous matter enough to seal up the wound, in a way infinitely superior to human ingenuity. Nor need we be afraid of wasting such sap by a too copious discharge; as, if the winter operations be discontinued at least a month before the sap is stirring, and the summer pruning do not commence till three months after that circumstance takes place, there is no danger to be apprehended. For not only is the end of the stump sealed up, but such sealing keeps it so much alive, that the wood, which afterwards grows over, always unites, either wholly or in part with it; so that, instead of defects, we have usually health and soundness, but never, except in the case of very large wounds, any thing of consequence enough to merit the name of detriment."

In the passage just quoted, Mr PONTEY appeals

to experience against those who object to pruning firs, on account of the large quantity of sap which exudes, or their *bleeding*, as it is very aptly termed, not pretending that it would not be hurtful to the tree, but merely contradicting the fact of such bleeding ever taking place. "A little of that much neglected article, experience," he says, "would teach them, or any others," (meaning his opponents), "that if a branch were cut off while alive, the sap-vessels would send out resinous matter enough to seal up the wound in a way infinitely superior to human ingenuity." Notwithstanding Mr PONTEY's boasted experience, however, the fact happens to be, that no such sealing up as he contends for ever takes place. The resin that distils from the wound does indeed congeal on it in cold weather; and it would seem to have been in such weather only that Mr PONTEY gathered his experience of the effects of pruning firs. But no sooner does a day of warm sunshine occur, than it melts, runs down the bark, and leaves the wound as open as ever. A new discharge takes place in consequence, which congeals and melts in its turn; and thus the process goes on, draining off and wasting by degrees the very life-blood of the tree. The re-

want of ready access must be severely felt. Were there no other advantage to be derived from roads, than the facility with which a plantation can, at any time, be examined, and its state ascertained by means of them, their utility would be manifest, and to omit putting the reader in mind of them unpardonable. The pleasure, too, that may be received from them, as walks, or rides, when the state of the weather is such as to demand either shelter or shade, is no contemptible argument in their favour; and, without them, it is indeed impossible to have the full enjoyment of forest scenery.

Roads in plantations ought to be contrived in such a manner as to afford as easy access as possible to every part. They should never be made straight, as, in that form, they would present a thoroughfare to the wind, than which there are few evils that should be more carefully avoided. The line of a road should be marked off, or rather the road itself should be fully formed, before we proceed to plant. The best way of performing the work will be to make a ditch on each side of the space intended for the road, the inequalities of which should be levelled with the earth, or gravel taken out of the ditches. Thus the two chief requisites of dryness and smoothness will be acquired at a very trifling expense. A

case of firs, this use of pruning has no place. Their horizontal branches never interfere with the leader, nor obstruct its progress in the smallest degree. It always, unless broken accidentally, or killed by the frost, appears above the most elevated of the horizontal shoots; and they, instead of injuring or supplanting, seem to assist it in keeping its perpendicular position, as those of the same elevation grew of equal length all around it, and produce a perfect equilibrium. Hence it would appear that the pruning of firs, supposing it harmless, can yet be productive of no positive good, so that to practise it would be to labour and lay out money for no end, a species of industry and expenditure which deserves any epithet but that of rational.

Harmless, however, the process in question is far from being, and I have known more than one thriving fir plantation utterly ruined by it. Mr PONTEY tells us, that it is the cutting off too many branches at once that causes injury, and that if we take away only two or three tiers at a time, no bad effect will ensue. Let any person remove this number of living branches from a Scots fir, or spruce, of seven or eight years old; let him, at the same time, ascertain its height, and mark some of the plants contiguous to it, which are exactly of the same

size. By measuring it and them three years afterwards, and comparing the progress of the former, made in this interval, with that of the latter, he will have a practical demonstration of the utter fallacy of Mr PONTEY's assertions. The taking off a few branches will not, of course, be so injurious as the displacing at once of a great number, but none can be displaced, as the above experiment will show, without materially retarding the growth of the plant.

I have said more on this subject than I otherwise would have done, as I know that PONTEY is considered as high authority on every thing that regards pruning; and I am willing to allow, that his precepts for the application of this process to deciduous trees, are more correct and rational than those of any other previous writer whom I have consulted. But his merits, in other respects, make his errors on the subject under consideration the more dangerous, by creating a deference for his opinions, which leads them to be adopted without due examination; and the following of his system too implicitly has already proved destructive to many a hopeful plantation of firs. If my strictures shall have the effect, in any degree, of preventing the like

mischief in future, the present publication will not add to the number of those volumes which are entirely useless to mankind.

With the exception of firs, I am acquainted with no kind of trees that may not derive more or less benefit from pruning, provided it be applied in a proper manner, and under due restrictions. To speak of it in this conditional form is necessary; for it may be, and often is, gone about in such an absurd way as to be productive of harm instead of good.

Every pruner understands that the object of pruning is to render the stem or trunk of the tree as tall and clean as possible, but few pruners seem to understand that mode of applying the process, which is most conducive for promoting this object. Many of them, in operating upon a young tree, proceed in nearly the same manner as if they were preparing it to serve the purpose of a fishing-rod or a walking-stick. Beginning with the branches next the ground, they clean all off before them to within a little of the top, and, with the exception of a few shoots there left, the plant is rendered as twigless as an osier willow in the hands of a basket-maker. They call this *dressing*, but *undressing* would be a far more appropriate term; for the unfortunate

object of their care is exposed to the blast, in a state of almost perfect nakedness.

This mode of pruning, though at first sight it may seem to answer completely the end intended, serves, in fact, for no purpose but that of ruining the tree. This will appear by attending to the economy of the sap, according to the most probable account of it that has yet been given. The roots, in the first place, extract this fluid from the earth, and it ascends through the stem and branches, till it reach the leaves*. By the latter it is elaborated and rendered fit for nourishment, which, without their agency, it would never become, any more than the food of animals would contribute to their support, if it remained in its original state, without

* PONTEY's theory is, that the use of the leaves is for attracting the sap from the roots, and that they are absolutely necessary for this purpose. But that this is altogether visionary, appears from the following considerations, or any one of them :—*First*, The sap ascends in spring before the leaves make their appearance; *secondly*, When the top of a tree is cut off, provided it be in a healthy state, and belong to any of the deciduous species, the sap, nevertheless, still ascends, and new shoots spring forth; *thirdly*, The same effects are consequent on the common practice of heading down plants when young. Were the leaves necessary to attract the sap upwards, it would rise in none of these cases.

being acted upon, and decomposed by the digestive powers of the stomach. After being fully prepared by the leaves, the sap again descends, feeding in its way, first, the branches; secondly, the stem; and, last of all, the roots. The branches bearing the leaves, then, which last may be called the digestive organs of the tree, are just as necessary to the other parts, as the other parts, not excepting the roots themselves, are to them. It follows, that if the number of branches be so reduced as not to carry a sufficient number of leaves for the elaboration of the sap, part of it will return in an unprepared state, and be of no use; so that the tree, after a severe pruning, will be deprived of a great part of the aliment which formerly it enjoyed. From this it is not to be concluded that pruning is useless, when conducted under proper regulations; for, by displacing a branch that overshadows several others, their leaves will be the better exposed to the air and light, and so become stronger and more able to perform their office, thus balancing the want of those that perish with the branch lopped off. But if the whole account of the circulation of the sap now given be not a delusion, to remove so many branches as is commonly done in pruning, is injurious in a degree almost beyond calculation. It tends to ren-

der the trees permanently dwarfish, and as unsightly when standing as they are inapplicable to any purpose of utility when cut down.

But it may be asked, How are we to know the exact number of branches that may be removed with safety in any given circumstances? Never, it is answered, displace any which have not already got, or seem in immediate danger of getting, the upper-hand of the leader. These will be known by their equalling, or approaching the leader in size; or, to speak less ambiguously, by their being of the same, or nearly of the same, girth at the place where they spring from the stem, as the *stem itself* is at *their length* from *its top*. This is the plainest rule that I can lay down for the guidance of those that are inexperienced, and if it be strictly adhered to, I think there can be no danger of depriving a tree of too many of its branches. I do not mean that the girths I speak of should be actually measured: this would be an absurd and endless task. The eye will judge of them with sufficient accuracy, and with such expedition as will not in the smallest degree retard the work.

In proceeding according to this plan, the pruner is not to regard, in the smallest degree, the part of the stem on which a shoot is situated. If it is too

large, it must be displaced, should it be in the highest part of the tree; if it is not too large it must remain, though it be close to the ground.

But how will this method, the reader may be ready to ask, ever produce a clean stem? By repeating the pruning, it is answered, as often as the growth of the branches may make the operation necessary. Suppose the first time a tree undergoes the process, that the branches removed are a considerable distance from the ground, and that there are several smaller ones left growing farther down the stem; these last will gradually increase in size, till they, too, must be lopped off, and thus the stem will be in the end as effectually cleared, though more gradually, and consistently with the health of the tree, as by the absurd method reprehended above.

If any branches that were left at a former pruning low on the stem, appear at the next repetition of the process not to have increased in size, we may safely conclude that they have had no influence on the tree either good or bad; and as it would be in vain to leave them with the hope that they will any longer assist in the elaboration of the sap, they should be removed as unsightly objects which it is no longer useful to preserve.

When a tree has, by any accident, lost its leader, a circumstance that frequently happens, we must single out one of the most upright of the branches to supply its place, and proceed in thinning out the rest precisely as is directed above.

In removing a branch, we should cut as close to the stem as can be done without ruffling the bark. Some writers recommend a snag of an inch or two long to be left as a means to prevent bleeding. But such snags are absolutely of no use for this purpose; and when they rot and fall off, they are apt to leave holes which are not only very unsightly, but extremely prejudicial to the wood, being sometimes instrumental in introducing rottenness to the inmost core of the tree. When we cut close and smoothly, without leaving any stump, the bark soon covers the wound, and leaves no more vestige of it than if it had never existed.

The proper instruments for pruning are knives of various sizes, a chisel with a long handle, to enable the operator to reach high branches, and the saw. These instruments should always be kept sharp and in good order; but the last mentioned should only be used for branches that are too large to be cut by either of the other two. On no pretence whatever should bills and axes be employed.

They can scarce be used without barking the stem, and they make rough unsightly wounds, and the percussion unavoidable in working them has very deleterious effects.

Among the other errors committed with respect to pruning, is that of being too long of beginning the operation. It is often never thought of till the trees are sixteen or twenty years old, by which means a great part of the advantage to be derived from it is irretrievably lost. It ought to commence even in the nursery, if the plants remain there more than four years; and at whatever age they are removed to their final destination, it should never be delayed longer than five years after such removal. In beginning the process so soon, very few branches will, in any instance, require to be displaced. In most cases not above two or three, in many, not more than one will be taken off; and in extensive plantations, not a few of the trees may be found, at this early period, in such a backward state as will induce the skilful forester to let them remain as they are, till a future opportunity. It does not, however, follow, that though little may require to be done, the doing of it will be of no use, or that the leaving of it undone will be productive of no injury. When many branches require to be displaced at once, it may always

be taken for granted that the tree has sustained considerable damage from some of them not having been removed sooner; and when we have to do with a large plantation, if we wait till the most backward of the trees stand in need of pruning, we may assure ourselves that the more forward ones have suffered severely from the want of it.

As pruning ought to be early begun, so it ought to be frequently repeated. Once every two years will be as seldom as is consistent with the mode of performing it here recommended. In the common way of executing it, indeed, there is no occasion for so frequent repetition, as the trees get such a thorough trimming at once, that they do not soon forget the infliction.

Pruning should be persevered in so long as a tree is in a growing state, but no advantage at all can arise from continuing it beyond this period. It is no uncommon thing to see a system of lopping and mutilation commenced on trees which have attained their full size, and remained stationary for years, with the preposterous design of compelling nature to resume her operations for promoting growth, after she has finally laid them aside. The effect intended is, of course, never produced; and the disfiguring of the tree is all that is gained by the experi-

ment. There is but one case in which there can be any propriety in pruning full grown trees, and that is, when they are top-heavy, as it is termed. In such circumstances, the removing or shortening of some of their longer branches will lessen the danger of their being split, broken, or torn up by the roots in storms and hurricanes. But it is only with trees which have not been duly pruned when young that this precaution will ever need to be adopted.

Formerly it was the general opinion that pruning should be executed in the winter months only, or the period which intervenes between the fall of the leaf, and the swelling of the bud, in spring. Of late years summer pruning has been strongly recommended; but, for my own part, I have not yet had an opportunity of seeing it practised on a sufficiently large scale to justify me in speaking either in its favour or against it.

Before concluding this article, it may be proper to say a few words on that mode of training by which trees are made to assume the peculiar shapes necessary for some of the purposes of ship-building. When an angular shape is required, as in the knee, it may be produced by stopping the upright leader, and making choice of such one of the lateral branches as may have the most proper inclination

to the stem, to supply its place. And this, in fact, is the whole secret of the art; for, if we can supply the ship-builder with wood having the angular shape, it belongs to himself to model it into the curvilinear forms necessary for some of his timbers. By bestowing a great deal of pains on trees when young, we might, indeed, be successful in making them assume the exact curves required, but the trouble of such a process would far exceed the profit; for though "as the twig is bent the tree" will invariably be "inclined," it is not to be inferred that this bending of the twig from the direction which nature has given it, can be accomplished without much vexation, care, and attention.

SECTION II.

THINNING.

In order that young trees may, as soon as possible, be in a capacity to shelter each other, we must, in planting, as has already been observed, crowd them into much less space than they will require before they can arrive at maturity. This renders thinning a necessary part of the forester's labour;

and, on its due performance, the success of every plantation will, in a great measure, depend.

There is an error which often leads to fatal results, very generally prevalent with regard to this process. It is considered as a cure for an evil that has already taken place, instead of what it in reality only is—a preventive of one that may be anticipated. This frequently leads its application to be delayed till it can be no longer useful; or, to speak more correctly, till it must, of necessity, be attended with effects that are actually pernicious.

The consequence that ensues from trees being too much crowded upon one another, is the exclusion of a due supply of air, and the result of this is, that they increase in height, without swelling proportionably in girth; or, to express it technically, they are drawn up weak. If they continue long in this state of suffocation, they, in a manner, change their nature. Vegetating, as it were, in the confined atmosphere of a stove, they lose their native hardiness, and become like tender exotics; so that they are no longer able to bear the admission of such a quantity of air as would be necessary to restore their vigour. Thinning, applied in such circumstances, instead of promoting recovery, tends only to accelerate dissolution; yet it is not till these very circumstances have

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actually taken place that its application is generally thought of.

In order that thinning may be really serviceable, it must be applied early. To specify any particular period would be useless, as this must depend on the quick or slow progress the plants have made since they were placed in the situation which they occupy. The best rule, and one, perhaps, that may be regarded as entirely unexceptionable, is to commence the process as soon as the branches of different trees begin to run foul of, and interfere with, one another. So long as a tree stands completely clear of those in its vicinity, the air can circulate about every part of it; and this is amply sufficient for all the purposes of vegetation. To cut down any of its neighbours while it remains in this state, would be to deprive it of the requisite shelter, and to hurt it by premature exposure.

Let it not be inferred, however, from what is here said, that it would be proper to delay the operation till the branches of *all* the trees of a plantation ran foul of each other. Before this took place, immense damage would be already committed, and things would, in fact, be in a condition that could receive no benefit from the process in question. If there should not be more than twenty trees among twen-

ty thousand which require relief, to these few such relief should be immediately given; and, when operations are once begun, on how small a scale soever, the plantation should be regularly inspected, once every two years, to ascertain whether a repetition of the same be necessary. By proceeding thus, all the bad effects of the common mode of thinning will be entirely avoided. The trees will neither be suffocated for want of air, nor starved by the too copious admission of it, inconveniences which can only be shunned by beginning to thin at the early period, and carrying on the process in the gradual and regular manner here recommended.

It is scarcely necessary to remark, that, in thinning, the worst trees should be cut down and the best spared, as the maxim is so obvious, that no one whom it would be prudent to trust in a wood with an axe, or any other edge-tool in his hand, can be supposed ignorant of it. Sometimes it will happen that two fine trees interfere with one another, while they are surrounded by inferior ones. In such a case, both the former should be allowed to stand, while all those in their vicinity, whose branches touch theirs, should be cleared away. Their close neighbourhood will thus do little hurt to either, as they will accommodate their growth to each other,

object of their care is exposed to the blast, in a state of almost perfect nakedness.

This mode of pruning, though at first sight it may seem to answer completely the end intended, serves, in fact, for no purpose but that of ruining the tree. This will appear by attending to the economy of the sap, according to the most probable account of it that has yet been given. The roots, in the first place, extract this fluid from the earth, and it ascends through the stem and branches, till it reach the leaves*. By the latter it is elaborated and rendered fit for nourishment, which, without their agency, it would never become, any more than the food of animals would contribute to their support, if it remained in its original state, without

* PONTEY'S theory is, that the use of the leaves is for attracting the sap from the roots, and that they are absolutely necessary for this purpose. But that this is altogether visionary, appears from the following considerations, or any one of them :—*First*, The sap ascends in spring before the leaves make their appearance ; *secondly*, When the top of a tree is cut off, provided it be in a healthy state, and belong to any of the deciduous species, the sap, nevertheless, still ascends, and new shoots spring forth ; *thirdly*, The same effects are consequent on the common practice of heading down plants when young. Were the leaves necessary to attract the sap upwards, it would rise in none of these cases.

that requires some care. As they will be large and weighty in comparison of those intended to remain, if they be allowed to fall on the latter, much damage will be the consequence; and I have seen very promising deciduous trees almost ruined in this way. The best method that I know of preventing mischief, will be to adopt the following artifice :—

Let the persons employed in felling be provided with a strong rope, and a ladder to assist them in climbing. Let the middle of this rope be fixed at such a height in the top of the tree intended to be cut down that the weight of the part below may considerably exceed that of the part where it is made fast. The ends of the rope are then to be tied firmly round the trunk of some one of the neighbouring trees to windward. By this contrivance, the tree which has the rope fixed amongst its branches, will, when cut through, instead of falling to the ground, remain suspended, and may be easily *guyed* to whatever side may be requisite to keep it from injuring any of its neighbours in coming down. The rope being then untied, the tree will prostrate itself harmlessly on the earth.

If the tree about whose trunk the rope is fastened be one of those intended to remain, it will be necessary to take some means of preventing injury to the

bark. A bag, stuffed with fog or straw, will answer this purpose if placed below the rope.

It may often happen, in taking firs nearly full grown from among deciduous trees, that none of the latter will be in a state sufficiently mature to sustain the weight of the former. In this case, men may be employed to pull the rope in the proper direction, or it may be made fast by a strong iron stake, driven into the ground with a mallet. When the wind happens to blow in the direction in which the tree is wanted to fall, none of these artifices will be necessary.

It has already been remarked, that, when thinning is delayed till the trees have suffered considerably for want of air, the application of it will then be productive of harm rather than good. This is especially true with regard to firs; and, in their case, if the proper time of beginning to thin be allowed to pass, it is wisest to abstain from the process altogether, and let the stronger trees make room for themselves by destroying the weaker. By this means, a much less number will arrive at maturity than would have been the case had thinning been timeously applied; but better this than run the hazard of ruining the whole by an injudicious attempt to effect a cure, by means of an operation that has no

efficacy except when applied as a preventive, before the symptoms of disease become visible.

In perusing this and the preceding section, the reader may be disposed to think that the management of woods, on the plan here recommended, will be productive of enormous expense. Upon trial, however, the mode of proceeding inculcated in these pages will be found cheaper than the slovenly and erroneous methods in common use. It is true, that, by the latter, so much work is done at once that few repetitions are required; but this does not in the smallest degree diminish the real quantity of labour. Suppose, in pruning, according to the directions of the foregoing section, that the operation is repeated five or six times before the plantation is twenty years old, it is evident that, at each of these times, few branches will require to be displaced, in comparison to the number that must undergo the same fate all at once, if we do not begin the process till the trees have reached the above mentioned age. It is evident, also, that there will be much more time required to cut every separate branch in the latter case than in the former, as, by pruning frequently, the shoots to be taken off must necessarily be of a much smaller size than when the process takes place more seldom. It is easier to cut

off six branches when the work can be done with the knife, than one which is so large as to require the saw; and, in the common mode of pruning, they are generally all of this last size. If there be any difference, then, in the labour, and, consequently, in the expense of the two systems, it is, that the one I have proposed has that difference in its favour. These remarks are applicable to thinning as well as to pruning.

CHAPTER VIII.

ON THE CULTURE AND MANAGEMENT OF OAK.

SECTION I.

OPINION THAT THE SOIL AND CLIMATE OF SCOTLAND ARE NOT CALCULATED FOR THE PRODUCTION OF OAK, EXAMINED AND REFUTED.

THAT the oak will not thrive in Scotland, is an opinion, which has, for some time, been pretty generally entertained, and which, instead of declining, seems at the present day to be gaining strength, and becoming more prevalent. It is pretended, that, in the nature of our climate, or in the qualities of our soil, or in both, certain principles exist hostile to the growth of oak, and that as we possess no controul over these principles, the most valuable of all forest trees can never with us be advantageously cultivated. Sentiments of this description are not only common among nurserymen and professional planters, but seem to be gaining ground

among such landed proprietors as have turned their attention to the rearing of wood on their estates; and hence, in many recent plantations, we see the oak entirely excluded, under the supposition that it is a tree which will not grow, where the Scots fir and the larch, or even the ash and the elm, may be brought to the highest degree of perfection.

As the prejudice in question stands opposed to one leading object of our undertaking; namely, to recommend the cultivation of oak as a source of individual profit and national advantage, it is requisite that some pains should be taken to refute it. This is the more necessary, because those who think the rearing of oak in this country a matter of impossibility, contend that their persuasion is founded on experience,—an assertion which has a tendency to disseminate the error, by leading others to adopt the opinion without due examination.

Before proceeding, therefore, to treat of the culture and management of oak, I shall occupy a few pages, first, in shewing the groundlessness of the idea, that either soil or climate are hostile to its production; and, secondly, in ascertaining the true causes of the results in which this idea has originated. The last mentioned part of the discussion

will naturally lead to the development of some principles, which will find their application in the subsequent part of the work.

To show that they have experience on their side, those who hold the above mentioned opinions adduce a great variety of instances, in which plantations of oak have totally failed. Now, I am prepared to allow, without prejudice to my argument, as I hope will appear in the sequel, that examples of this nature are abundantly common throughout the country; nay, that they have occurred nearly as often as attempts have been made to rear that tree during the last fifty years. In the districts with which I am most intimately acquainted, comprehending the five northern counties of Aberdeen, Banff, Moray, Kincardine, and Forfar, oaks have been planted, within the above mentioned period, to the amount of several millions. Of this immense quantity nine-tenths have perished without growing so much as to overtop the heath, and of the remainder, a great proportion have made so little progress, and exhibited such a weak, sickly, stunted appearance, as almost excludes the hope of their ever arriving at the size of timber fit for any useful purpose. But while I willingly grant that we have had unquestionable experience of such failures, I strenuously deny that we have any experience

which, in one out of five hundred instances, justifies us in laying the blame either on the climate or soil. If experience taught us that want of success in the cultivation of any plant could proceed from these sources only, then I confess the opinion I am combating would be most firmly established. But we are certain that culture has in the vegetable world scarce less influence than either; and that where this is conducted on wrong principles, it will be in vain to look for a productive crop, let climate and soil be ever so favourable. On seeing an indifferent field of turnips, it would be far too hasty a judgment to conclude the land to be bad, solely on the evidence of the observed deficiency; because such deficiency, as every one knows, might proceed from no other cause than imperfect tillage. In like manner, that oaks have not thriven when planted in any given piece of ground, does not prove that such ground is incapable of producing them, till it be first ascertained that the treatment they received while in the nursery,—their being transplanted,—the method in which that operation was performed,—and numerous other particulars respecting their culture, were perfectly suitable to their nature. Nor does it in the least degree invalidate this reasoning, if any other kind of trees should have pros-

pered in the same quality of land where oaks have perished, even though the treatment of the former should have been in every respect similar to that of the latter; because the mode of culture which is found to answer with one species of plants is often in the highest degree injurious to another. No farmer would think of proceeding exactly in the same manner in rearing cabbages and turnips. Transplanting, which is the life of the one, is known to succeed very indifferently with the other.

If there be any truth in these remarks, it surely is incumbent on those who pretend that either our soil or climate is decidedly unfavourable to the growth of oaks, and lay to the charge of one or other, or both of these, the disappointments which have so frequently attended endeavours to rear that species of trees; it is certainly incumbent on them to show, before we can rationally acquiesce in their judgment, that the mode of culture has been perfect, and that to it none of the alleged failures can be imputed. Till they can do this, it is evident that their opinion, instead of being built, as they imagine, on the rock of experience, is erected on the baseless foundation of mere gratuitous assumption.

Those, indeed, who consider our climate as the

cause of the results in question, may be refuted at the expense of a very few sentences. Oak trees, though they have become scarce in Scotland, are not yet entirely awanting. In every county, a few tolerable specimens are to be found; in some instances we even meet with very fine ones. Now, though those who impute the fault to the soil, evade any argument hence derived, by pretending that these instances occur in a quality of land which has no parallel in any that now remains to be planted, those who impute it to the climate cannot, with any degree of consistency, advance a similar plea. The soil is known to change almost with every change of place. In one part of the same field it may consist of clay, in another of loam, and in a third of gravel. But this cannot be said of climate, which, in as far as regards heat and cold; the circumstances that principally affect the growth of plants, is the same, or nearly so, through the whole kingdom. In summer, the thermometer rises as high in Morayshire as in the Lothians, and in winter indicates as great intensity of cold on the banks of the Forth as on those of the Spey. If, then, the climate is capable of bringing oaks to perfection at Dunkeld or Breadalbane, in Perthshire, at Glammis, in Angusshire, and at Invercauld, or

Aboyne, in Aberdeenshire, it is capable of bringing them to equal perfection at all the intermediate places, and in any other part of Scotland. If it be answered, in reply to this, that the situations where thriving oaks occur are only such as possess the advantage of shelter, I have not the slightest hesitation in giving my assent; as I am most firmly persuaded by evidence derived both from observation and actual experiment, that want of shelter is one of the real causes why plantations of oak have generally succeeded so ill in this country. But this is a want that can easily be supplied by artificial means, as I shall show in a future part of this work; and all I have to do at present, is to prove that nature has interposed no difficulties to the rearing of oak in Scotland, which are insurmountable, or beyond our controul.

The opinion, then, that our climate is such as ought to dissuade us from the culture of oak, instead of being dictated by experience, seems entirely repugnant to it, and I shall now proceed to demonstrate, that the similar opinion with regard to our soil is equally ill supported. And as it is insinuated, however, falsely, that the examples of full grown oaks, which occur at present, are to be met with only in situations so peculiar as not to entitle

us to conclude that the species will thrive on such land as we can now spare for the growth of timber, let us inquire whether that species was a native of the vast natural forests which once existed in Scotland? If we have any faith either in history or tradition, we must be convinced that the affirmative is the truth. For, from both these sources, we may gather directly, as well as indirectly, that the oak was not only to be found here and there in these forests, but that it abounded in them,—that it was not confined to a few districts, but was diffused over the whole country,—that it attained to a great size,—that oak timber was employed in the various departments of building and artificers' work, and that oak billets were used for fuel; nay, that oak was so plentiful, and its preservation deemed as a matter of so little consequence, that large tracts of it were sometimes burnt down, not only for the sake of clearing the ground, but even on the strange pretence of dislodging a few miserable outlaws or banditti.

From history and tradition, then, the opinion of those who say that our soil is not generally qualified for the production of oak, derives not support, but confutation. Lest, however, they should doubt or discredit such sources of evidence, we have proof of

a yet more decisive character to submit to their consideration.

Such of our ancient buildings* as have stood the

* The devastations of war formerly, improvements in more recent periods, and the dilapidations of time in addition to both these causes, have swept away most of the ancient habitations of our nobility and gentry, while the greater part of the old churches and religious houses were dismantled at the Reformation. As many still remain, however, as will serve to confirm and illustrate what is here asserted. I shall just mention two or three examples in the northern part of the country, where oak is now seldom found in a growing state, and where the difficulty of raising it is supposed to be greatest.

The most ancient part of King's College, Aberdeen, that, namely, which now forms the Chapel and Library, has its timber work all of oak. This building is nearly 400 years old. It contains some richly carved work of oak, which is as free from decay as the day it came from the hands of the workmen. The ceiling likewise, and the fronts of the galleries in the neighbouring cathedral, a structure of equal age, and which is now the Parish Church of Old Machar, are of the same material, and in an equal state of preservation. Eighty miles north-west of Aberdeen is Darnaway Castle, a seat of the Earl of Moray, in the county from which he derives his title. The roof of the noble hall of this building is of oak, and was the work of Randolph, one of the most renowned followers of Robert Bruce. This hall likewise contains a chair and table, both of oak, and of most ponderous weight, once the property of the same hero. Another chair of the same material,

shocks of time, and exist at the present day in a tolerably entire state, afford ocular demonstration, that oak was extensively used by our ancestors for

which belonged, as is said, to MORAY the Regent, and brother of Queen MARY, and several others that were saved from the wreck of the Cathedral of Elgin, form part of the furniture of this hall. The last serve to indicate, that the timber-work of that building, of which the naked walls now alone remain, was also oak.

The following curious account, taken from the Caledonian Mercury of September 7. 1829, is, if possible, a still better illustration. "Among the remarkable circumstances brought to light by the late flood," (namely, that of the 3d of the month), "is the discovery of a wooden bridge, over the River Dee, a little above Ballater, the existence of which must be referred to a very remote period of antiquity, as neither record nor tradition make any mention of such a structure. It had stood about half a mile above the recently destroyed bridge of Ballater, to the west of the hill of Craigendarroch, and was laid bare by the late flood striking against the bank at the bottom of that hill. The bridge had been composed of huge oaken logs, with cross beams mortised into piles of the same material, standing a considerable height above the bed of the river, the tops of the piles, which are now worn away, being destined probably to support the path-way of the bridge,—as there were neither carts nor carriages in "thae" days. The oak framing, which is as fresh as the day it was laid down, is composed of trees above eighteen inches square."

architectural purposes. In our old churches and baronial residences, where the timber-work has not been renewed in modern times, we find it, with scarcely a single exception, consisting either wholly or principally of oak. This is true of all such structures, from those of the earliest date that yet remain, down to the erections of the sixteenth century; nor have we the slightest shadow of reason for believing, that these edifices were composed of different materials from innumerable others of co-eval periods, which no longer exist. And if we are certain, from the testimony of our eyes, that the roofs, the floors, and the massive doors of our ancient buildings were composed of the most durable of all kinds of wood, we are no less sure that the furniture of their apartments were formed of the same; and the ponderous chairs, tables, bed-steads, &c., which have been handed down to us, demonstrate that the cabinet-makers of those days had ample, as well as cheap, supplies of timber. We may safely add, that if our Gothic forefathers were thus liberal in the use of oak for the above mentioned purposes, it is in the highest degree improbable they should have been less so in the fabrication of ships, or that, with their proverbial love of strength and solidity, they should, in a department where these qualities

are perhaps more indispensable than in any other, have made use of any but the strongest and most solid materials.

It would appear, then, that in ancient times oak was universally employed in the various branches of carpenter and joiner work; and if this was the case, the quantity of it produced in Scotland must have been immense; as in those days there was no such thing as importation of timber from abroad. And it is proper to observe, before leaving this part of the subject, that its abundance is not proved merely by the common and extensive use of it, but by the circumstance, that it could not, at least in inland places, be carried to any considerable distance from the forest where it was cut down; for the means of conveyance were then in a very imperfect state, the roads being extremely inconvenient for draught, and carts or waggons scarcely known. The wood, as well as the stones of a building must, therefore, have been found in its immediate neighbourhood, or at farthest, within the compass of a few miles; and hence we are entitled to conclude, that it was diffused as generally over the kingdom as were the churches and feudal castles in whose construction it was used.

We have yet another source of evidence still more

certain, if possible, than any of the former, in the well known fact, that remains of oak have been found in our peat-mosses, from time immemorial, down to the present day. This is the case in parts of the country now entirely destitute of any kind of wood, and supposed to be peculiarly unfavourable to its production. Along the east coast from Aberdeen, to the farthest north point of Caithness, a tract where the rarity of trees is now proverbial, there is not perhaps one such moss in which remains of this nature have not, one time or other, been dug up, sometimes in entire trees of large size, sometimes in small fragments, and sometimes in acorns. The same is true, almost without exception, where ever peat-moss occurs. Those who are curious on the subject, will find a variety of instances on record, by consulting the proper articles in *Sir John Sinclair's Statistical Account of Scotland.* Several examples have come under my own observation. I recollect having seen, not many years ago, at Crabstone, in the parish of Newhills, within five miles of Aberdeen, a gigantic oak-tree, which was disinterred by some workmen employed in trenching a piece of mossy land, that had not previously been in tillage. The wood of the tree was perfectly fresh; and its trunk so large and weighty, that it had to be cut

in several transverse sections before it was possible to remove it from the bed where it had probably reclined for ages. This happened in a part of the country so far from being noted for its fertility, that it is situated in what has, not unaptly, been termed the "barren zone" of Aberdeenshire; and the subsoil of the very spot where the tree had grown, was that sort of blue clay which is impervious to water, and is considered by agriculturists as very poor and unproductive. The above and other specimens have come under my notice by chance, as it were, and without my having ever resided, for any considerable length of time, in parts of the country where peat-mosses are very abundant.

The quantity of oak which at one time or other has been thus dug up in Scotland, amounts to more, perhaps, than could, at the present day, be collected from the forests of both the United Kingdoms. How well, then, must the Scottish woods have been originally stocked with this sort of timber, since our ancestors, with all their wasteful prodigality, could not consume it so fast as it came to maturity; but left much of it to be annihilated by the process of natural decay, or rather to be embalmed, if we may use the expression, in the mosses which itself contributed to form, that it might be disinterred in future

efficacy except when applied as a preventive, before the symptoms of disease become visible.

In perusing this and the preceding section, the reader may be disposed to think that the management of woods, on the plan here recommended, will be productive of enormous expense. Upon trial, however, the mode of proceeding inculcated in these pages will be found cheaper than the slovenly and erroneous methods in common use. It is true, that, by the latter, so much work is done at once that few repetitions are required; but this does not in the smallest degree diminish the real quantity of labour. Suppose, in pruning, according to the directions of the foregoing section, that the operation is repeated five or six times before the plantation is twenty years old, it is evident that, at each of these times, few branches will require to be displaced, in comparison to the number that must undergo the same fate all at once, if we do not begin the process till the trees have reached the above mentioned age. It is evident, also, that there will be much more time required to cut every separate branch in the latter case than in the former, as, by pruning frequently, the shoots to be taken off must necessarily be of a much smaller size than when the process takes place more seldom. It is easier to cut

bouring moor-land. Often, indeed, it consists of the identical blue clay or till which has been mentioned above, and whose productive powers are commonly deemed of so indifferent an order. Upon the whole, it may be safely asserted, that the quality of the soil in which remains of oak are now found, is decidedly inferior to at least two-thirds of our land which at present lies entirely waste, and which, therefore, might be planted with wood, without in the least degree injuring the interests of agriculture, or any other interests whatever.

That large oak trees, then, did in former times grow plentifully in Scotland,—that they prospered on land which at present is not better in quality than many hundreds of thousands of acres which are still unimproved, seems to be clear beyond the possibility of doubt. Has our soil, then, become worse than it was formerly? That it should have done so is as improbable as it is unaccountable on any known principle. The surface of high hills indeed, is liable to reduction from the action of frosts and rains; but granting that elevated ground should, from such causes, be now much deteriorated, the same does not hold good with regard to the valleys and plains. These, on the contrary, ought to be enriched, in the same ratio as the mountains are im-

CHAPTER VIII.

ON THE CULTURE AND MANAGEMENT OF OAK.

SECTION I.

OPINION THAT THE SOIL AND CLIMATE OF SCOTLAND ARE NOT CALCULATED FOR THE PRODUCTION OF OAK, EXAMINED AND REFUTED.

THAT the oak will not thrive in Scotland, is an opinion, which has, for some time, been pretty generally entertained, and which, instead of declining, seems at the present day to be gaining strength, and becoming more prevalent. It is pretended, that, in the nature of our climate, or in the qualities of our soil, or in both, certain principles exist hostile to the growth of oak, and that as we possess no controul over these principles, the most valuable of all forest trees can never with us be advantageously cultivated. Sentiments of this description are not only common among nurserymen and professional planters, but seem to be gaining ground

I might have left the question to be decided by these alone, as they are of such a nature that they may be easily repeated by any one who is so inclined. But as the matter seemed susceptible of being set at rest without reference to any experiments whatever, I thought it would detract nothing from the value of this work to insert the facts which may be used for that purpose.

I need hardly seek to guard against misrepresentations, by stating, that I never meant to assert that oak will grow indiscriminately on any soil. There is, undoubtedly, much land, in Scotland, which will produce no kind of wood; nay, which will not even bring our hardy national emblem, the thistle, to perfection. Our mountains, for instance, after they reach to a certain height, become so destitute of vegetable mould, while the air is so keen and piercing, that the heath itself disappears. Even on less elevated ground, pieces of invincible sterility are found. But exclusive of all such, we have millions of acres remaining, on which, with proper management, we need not despair of seeing the oak succeed as well as it did in former ages.

SECTION II.

ON THE DEFECTS AND ERRORS OF THE COMMON METHOD OF PROPAGATING OAK.

Total failures in attempts to raise oak in some districts of the country, and its slow growth in others, have gradually given rise to an opinion, that this tree is too delicate for our soil and climate; and, consequently, that it can never be rendered a lucrative object of cultivation to the grower of timber. That this opinion is founded on misapprehension, and entirely groundless, the author has already endeavoured to prove. In the present section, which is intended as an introduction to the new plan of raising oak, submitted to the reader in the subsequent part of this volume, he will have an opportunity of explaining the true causes of the failures in question, and of demonstrating, from the nature of the tree, as well as from actual experiment, that these causes lie wholly in erroneous and defective modes of culture.

The most important characteristic of the oak, in studying it with an eye to ascertain the method of

cultivation most proper for ensuring its speedy and free growth, is, that it belongs to that class of plants which gardeners denominate tap-rooted. When a seedling of one or two years old, it has a root, which, though smaller, is shaped exactly like a carrot, and is nearly as destitute of fibres. Now, it is well known that almost all trees, shrubs, and vegetables of this description, agree very ill with transplantation. Horticulturists and nurserymen are so completely aware of this, that, in removing valuable plants of the kind specified, they lift them, when posssible, with a ball of earth adhering to their roots. This artifice is the best that can be adopted, when only required on a small scale, and when the plants grow in such a manner as to allow of its being easily carried into effect. But to apply it to oaks growing in a crowded seed-bed, or nursery-line, is obviously impracticable; and, if it could be thus applied, the attempt would be precluded by the expense, which, in forming even an inconsiderable plantation of a few acres, would be enormous. Oaks, therefore, on being transplanted, must undergo the process in the same manner as other plants with which it better agrees, and the consequences are, first, that many of them die immediately after the operation, and, secondly, that those which sur-

vive are, in most cases, so materially injured as to grow but slowly afterwards, and never to attain their full and natural size.

Of the pernicious effects which transplanting has upon oak, every one who has had opportunities of paying attention to the various operations of the nursery must have seen many examples. For the sake of others, the following easy experiment is suggested; and it is presumed that any impartial person who will take the trouble to make it, will be convinced that to transplant oak is a great and radical error in the cultivation of that valuable species of timber.

Select a piece of tolerably rich land free from perennial weeds, and secure from the irruptions of cattle and similar casualties. Dig it a foot deep in the month of March, taking care to break it well with the spade, and to throw out all large stones. After letting it dry for a few days, proceed to crop it with acorns as follows:—Open drills of about an inch deep, and eighteen inches asunder, being careful, while performing this work, to harden the ground as little as possible with the feet. In these drills, plant acorns at one foot asunder, and cover them by drawing the earth over them. When the plants appear, which they will do in May, all weeds that

have arisen must be pulled out with the hand, and this is to be repeated as often as necessary during the summer. Early next March, let the plants in one half of the rows be pulled up, slackening them well with a spade that their roots be as little injured as possible. Dig the ground thus left empty to the same depth as last year, and replant it immediately with the young oaks just taken out of it. This is to be performed with a dibble, taking care to fix well, and not to double the roots, to avoid doing which it will be necessary to prune off the extremities with a sharp knife; but the amputation must be very sparing, otherwise the death of the plants will inevitably follow. The oaks are to be kept at the same distance *in* and *between* the lines as were the acorns from which they grew the preceding year, and, as well as those not transplanted, must be kept free of weeds during the ensuing summer, either by hoeing or pulling with the hand.

An experiment conducted in the manner now described is perfectly fair, and must therefore be decisive. The whole of the oaks are sown at the same season, and in the same ground, and have equal advantages, in every other respect, during the first year. The replanting of those taken up, in the place they formerly occupied, instead of remov-

ing them to another situation, precludes every doubt that might arise, were they so removed, as to their being on an equal footing, as far as regards strength and quality of soil, with those not transplanted; and their close juxtaposition with the latter, renders it a matter of the greatest facility to ascertain their comparative growth. The space, too, allowed the plants, which much exceeds that generally given in the nursery, will admit of the experiment being carried on, for several years, without inconvenience.

To be convinced, therefore, of the bad effects of transplanting, nothing farther will be necessary than to watch the future progress of these transplanted and untransplanted oaks. During the droughts of June and July, a number of the former will go off or die, notwithstanding that the greatest care may have been taken in planting them; and by the time of the fall of the leaf, the difference between the survivors and those which were not transplanted will be so striking, as hardly to escape the notice even of the most careless observer. While the latter will have made strong upright shoots of from twelve to eighteen inches, according to the poorness or richness of the soil, the former will have made no progress at all in the direction of the leader, (which transplanting indeed generally destroys);

and will have thrown out a few insignificant lateral shoots only, of two, or at most of three, inches long. Nor will the superiority of growth of the untransplanted oaks end with the first year. Next season they will still outstrip the others considerably, and they will continue to do so for several successive summers; so that if both be allowed to remain in their situation till they are six years old, the difference between them will be found to be much greater than it was the second autumn. And it will not only be the inferiority in size of the transplanted oaks which will, at this time, constitute the distinction between them and the others: The transplanted oaks will be bushy at top, and have their shoots and branches in a horizontal direction, so that the skill of the pruner, exerted even at this early period, will, in many cases, fail in training them up to be straight and handsome trees: The untransplanted ones, on the contrary, will have strong upright leaders, which, with comparatively little trouble, may be made to grow perpendicularly, till they arrive at the height of twenty or thirty feet.

According to the best method of propagating oak which has yet been practised in Scotland, that tree undergoes transplantation twice; once in the nursery, and again when it is removed to its final des-

a yet more decisive character to submit to their consideration.

Such of our ancient buildings* as have stood the

* The devastations of war formerly, improvements in more recent periods, and the dilapidations of time in addition to both these causes, have swept away most of the ancient habitations of our nobility and gentry, while the greater part of the old churches and religious houses were dismantled at the Reformation. As many still remain, however, as will serve to confirm and illustrate what is here asserted. I shall just mention two or three examples in the northern part of the country, where oak is now seldom found in a growing state, and where the difficulty of raising it is supposed to be greatest.

The most ancient part of King's College, Aberdeen, that, namely, which now forms the Chapel and Library, has its timber work all of oak. This building is nearly 400 years old. It contains some richly carved work of oak, which is as free from decay as the day it came from the hands of the workmen. The ceiling likewise, and the fronts of the galleries in the neighbouring cathedral, a structure of equal age, and which is now the Parish Church of Old Machar, are of the same material, and in an equal state of preservation. Eighty miles north-west of Aberdeen is Darnaway Castle, a seat of the Earl of Moray, in the county from which he derives his title. The roof of the noble hall of this building is of oak, and was the work of Randolph, one of the most renowned followers of Robert Bruce. This hall likewise contains a chair and table, both of oak, and of most ponderous weight, once the property of the same hero. Another chair of the same material,

seem to be retrograde. They will not be so far restored even the following season as to appear in full verdure; and two years will thus pass away without their making any sensible advancement. Of all these results I speak with confidence, because I have seen them exemplified, not in one solitary instance only, but in many during a period of fourteen years in which my occupation lay chiefly in the nursery.

Some persons may object to the above experiment on account of the length of time it requires. In order, however, to form a tolerably correct estimate of the merits or demerits of transplanting, it will not be necessary to carry it on above three or at most four years. At the end of that period, the difference between the untransplanted and transplanted oaks, with the legitimate inferences which may be drawn from that difference, will be sufficient to point out to the unprejudiced the impropriety of the common mode of culture. The intelligent observer will not merely regard the disparity of growth between the plants thus differently treated; but the marked disparity in their manner of growth. He will notice, that, in the untransplanted oaks, the vegetative power has been chiefly exerted in producing shoots comparatively few in number, but strong and upright; while in the transplanted, the same

power has dissipated itself in throwing out a number of puny insignificant twigs, all in a lateral direction, and none of them of sufficient consequence to take the lead in bringing up the tree. To conclude from such appearances that the former will not only retain but increase the superiority which they have already acquired over the latter, and that they will ultimately become larger and more handsome trees, is merely the dictate of common sense. In the one, the sap is concentrated in the production of what is chiefly desirable,—straight and thriving stems; in the other it is divided among a multitude of branches, each of which must therefore grow with a slowness proportioned to the scantiness of its nourishment. Nor can the skill of the pruner be applied at a period sufficiently early to remedy these defects either of figure or growth; for when the shoots of a plant are very small, grow collaterally, and are all nearly of the same size, it is impossible to determine, with any degree of accuracy, which it is most proper to preserve, and which to lop off. Besides, it is consistent with experience, that plants of any kind having received a check which obstructs their vegetation for more than one season, become *hide-bound* as it is termed, or, in other words, contract a disease which, without absolutely killing

them, arrests their progress, and keeps them stationary till a cure be effected by some artificial means. That transplanting, especially a second time, is fully adequate to induce this disease upon young oaks cannot be doubted, when we consider the sickly and languid state in which they remain for at least two years after undergoing the process.

If what has now been advanced be in any measure correct, the oak, instead of being transplanted, ought to be raised from the acorn in the place where it is intended to remain *. The methods of cultivating it, therefore, which have hitherto been practised in Scotland, and as far as I know in other countries, are radically wrong. The least exceptionable of these is as follows :—When a piece of waste land is to be planted, oaks are procured from the nursery of from three to five years old, having been previously transplanted. Holes, or pits as they are termed, are then made with the spade, at about four feet distance from one another; into these the roots of the plants are inserted and covered with earth. Now,

* Since writing this work, I have learned, that the plan of raising oaks from the acorns, in the spots where they are intended to remain, has been recommended by authority far superior to mine, viz. by Dr Yule, in the Horticultural Memoirs, and by Mr Sang in the Planter's Calendar.

it is admitted that this mode of proceeding would be liable to few or no objections, could the oak, like the ash, beech, and elm, be transplanted without injury. The pitting system enables the planter to make sufficient space to contain the roots, without either doubling or pruning them too closely; it makes the fixing of them an easy matter, and by effectually loosening the earth, takes away any obstruction which might arise from hardness to the pushing of fibres. It is only fair, therefore, to allow, that could oaks at all bear transplantation, scarcely any better mode of executing it, especially in waste land, could be devised, than the one just mentioned. But if, as we have already seen, that operation, when performed in the most approved manner, is attended with the most deleterious effects even in the nursery, the consequences following it in the wastes and moorlands, which are allotted to the growth of wood, let the planter do his utmost, are still more pernicious. Any sort of tree which has grown for a considerable time in rich cultivated soil, where it has been habituated, so to speak, with plentiful supplies of the most luxurious nourishment, receives a considerable check when removed to a situation where the sustenance is comparatively poor and scanty. Such a change must

be doubly prejudicial to oaks which, after having their health impaired by previous transplantation, have again to struggle with the evils of a second removal. We have no cause to wonder, then, that, when treated in this way, they often remain for years in a sickly condition, and, in the end, become so thoroughly hide-bound, that they require to be lopped down to the ground, before they will put forth a single healthy shoot. It may be worth while to add here, that, from ignorance of this method of cure, whole plantations of oak have often been suffered to perish.

Besides that now described, there is another way of planting oaks, which has been much practised in Aberdeenshire and some of the neighbouring counties, during the last twenty or thirty years. Seedlings of one or two years old are used, and the plan of operation is as follows:—A notch is made on the ground with a spade, or with an instrument known in these districts by the name of a planting iron. The root of the young oak is inserted in this notch, which the workman then closes by a stroke of his heel, and thereby fixes the plant. This method is the cheapest of any that has ever been practised, and, simple as it is, answers to admiration with Scots fir, larch, and spruce of one or two years old.

All these species agree well with transplanting, and readily strike root, provided they be fixed in the earth, without requiring any peculiar delicacy of management. But when applied to oak, the notching system deserves to be reprobated as in the last degree absurd and preposterous. The justness of this remark will be rendered obvious, by considering the process in question a little in detail.

In the *first* place, there is little waste land in which it is possible to make a notch deep enough to admit the roots of a seedling oak straight and at full length. It becomes necessary, therefore, either to double the roots, or to cut off a large portion from their extremities—methods which are equally pernicious. The former is inconsistent with the free growth of any plant, and the latter takes away from the oak the very part which, from its approaching to a fibre, is the seat of vegetation, and what remains is nearly in the predicament of a mere cutting or slip.

Secondly, The notching system leaves the ground exactly in its natural state without softening it, or creating any loose mould to encourage the production of new fibres.

Thirdly, The notches can never be so effectually closed as to prevent the roots from being scorched

by the dryness of the weather, at the critical period when the plants should begin to vegetate. As far as regards the fir tribes this is of little importance, as they commence growing at a season so early that their roots have taken firm hold of the earth before the drought has become so intense as to do them any material injury. But the oak, late of vegetating under any circumstances, is peculiarly so after being transplanted; and the droughts of May, and the beginning of June, if admitted to its roots, will have them completely dried up before the plant has had time to put forth a single leaf.

There is no reason to seek the causes why oaks should not thrive when treated thus, in any other quarter than the treatment itself. When we consider the antipathy they have to being transplanted, and, at the same time, weigh the glaring defects of the process just described, the want of success which has attended it is thoroughly explained. It is a process, in fact, which, with regard to oaks, is scarcely less calculated to ensure destruction than if the tops of the plants were put into the earth, and their inverted roots exposed above ground, to be bleached in the rains, and withered to pulverization in the sunshine and the breeze.

Transplanting (especially when conducted on such

wretched principles as those of the notching system, may be considered as the chief, but it is not the only, error in the present mode of cultivating oak. Second to it, and only a few degrees inferior in producing bad effects, is to be reckoned the almost universal neglect of providing shelter for the young plants. The want of this causes them, in every situation, to grow extremely slow, and in very high grounds often entirely destroys them. All kinds of wood grow better when sheltered than when fully exposed to the unmitigated severity of the weather, and unbroken force of the winds. This is proved by the fact, that neither do single trees, nor those planted in clumps, in hedge-rows, or in belts, though upon equal terms with regard to soil, ever thrive so well as those in plantations of some extent. Even in the latter, the outside trees are always more stinted than the interior ones, a circumstance which shows in the plainest manner the advantages of protection from the wind, and the evils that arise from exposure.

If, then, it may be said with regard to forest trees in general, that they are nursed by shelter, and injured by the want of it, the same proposition is more emphatically true in the particular case of the oak. Its leaves and young shoots are, when they make

their first appearance, extremely tender. The former are subject to be blackened and shrivelled in the blast; the latter are brittle, and break like ice. Both are very liable to be bitten by frost; the leaves in spring, the shoots both in spring and autumn. It is only, therefore, where oaks are well sheltered from the inclemency of the weather that they grow with any tolerable quickness: "The epithet hardy," says PONTEY, "has been so constantly applied to the oak, that what is only true of the *wood*, is generally believed of the *vegetable*; hence we very naturally overlook the real treatment to which inattention exposes it. But certainly the season in which it vegetates, or the circumstance of its first shoots being frequently destroyed by frosts late in May, exhibits no proofs of hardiness; and the same may be gathered from the woodman's remark, that the bark is frequently difficult to take off in cool weather. Nor does its being found upon very cold exposures prove the fact, but much to the contrary. "The starveling oak upon the mountain's brow" is almost proverbial; it will *live*, but can never *thrive* in such a situation. The truth is, that the plant requires a considerable portion of warmth, not only to put its juices in motion, but to keep them so; as is proved by its appearance and progress in different degrees

SECTION II.

ON THE DEFECTS AND ERRORS OF THE COMMON METHOD OF PROPAGATING OAK.

TOTAL failures in attempts to raise oak in some districts of the country, and its slow growth in others, have gradually given rise to an opinion, that this tree is too delicate for our soil and climate; and, consequently, that it can never be rendered a lucrative object of cultivation to the grower of timber. That this opinion is founded on misapprehension, and entirely groundless, the author has already endeavoured to prove. In the present section, which is intended as an introduction to the new plan of raising oak, submitted to the reader in the subsequent part of this volume, he will have an opportunity of explaining the true causes of the failures in question, and of demonstrating, from the nature of the tree, as well as from actual experiment, that these causes lie wholly in erroneous and defective modes of culture.

The most important characteristic of the oak, in studying it with an eye to ascertain the method of

have already received. It causes them, when they happen to arrive at any considerable height, to exhibit the appearance of gigantic shrubs, rather than trees, and their wood is so worthless, from its smallness, that the proprietor sells them at little less than their full value, when he receives for them the price of their bark.

Oaks in this country are seldom planted alone; they are for the most part intermixed with other trees. In this state they are often spoiled by the plantations being too much crowded, an evil which ought to be remedied by timely thinning. Here I wish it to be understood, that I by no means disapprove of planting other trees, especially the Scots fir and the larch, along with oaks. On the contrary, even when the latter are intended to be the principal crop, the ground should be well filled with either or both of the former, and that for several years, before the oaks are planted. This, in fact, is the only means, in exposed situations, of providing the requisite shelter. What I here find fault with is, that proper care is not taken to thin out these less valuable kinds, when their branches have become so large as to overhang the oaks, or exclude the supplies of air necessary to preserve them in a healthy state. This negligence is the more to be blamed,

vive are, in most cases, so materially injured as to grow but slowly afterwards, and never to attain their full and natural size.

Of the pernicious effects which transplanting has upon oak, every one who has had opportunities of paying attention to the various operations of the nursery must have seen many examples. For the sake of others, the following easy experiment is suggested; and it is presumed that any impartial person who will take the trouble to make it, will be convinced that to transplant oak is a great and radical error in the cultivation of that valuable species of timber.

Select a piece of tolerably rich land free from perennial weeds, and secure from the irruptions of cattle and similar casualties. Dig it a foot deep in the month of March, taking care to break it well with the spade, and to throw out all large stones. After letting it dry for a few days, proceed to crop it with acorns as follows:—Open drills of about an inch deep, and eighteen inches asunder, being careful, while performing this work, to harden the ground as little as possible with the feet. In these drills, plant acorns at one foot asunder, and cover them by drawing the earth over them. When the plants appear, which they will do in May, all weeds that

have arisen must be pulled out with the hand, and this is to be repeated as often as necessary during the summer. Early next March, let the plants in one half of the rows be pulled up, slackening them well with a spade that their roots be as little injured as possible. Dig the ground thus left empty to the same depth as last year, and replant it immediately with the young oaks just taken out of it. This is to be performed with a dibble, taking care to fix well, and not to double the roots, to avoid doing which it will be necessary to prune off the extremities with a sharp knife; but the amputation must be very sparing, otherwise the death of the plants will inevitably follow. The oaks are to be kept at the same distance *in* and *between* the lines as were the acorns from which they grew the preceding year, and, as well as those not transplanted, must be kept free of weeds during the ensuing summer, either by hoeing or pulling with the hand.

An experiment conducted in the manner now described is perfectly fair, and must therefore be decisive. The whole of the oaks are sown at the same season, and in the same ground, and have equal advantages, in every other respect, during the first year. The replanting of those taken up, in the place they formerly occupied, instead of remov-

SECTION III.

NEW METHOD OF REARING OAK DESCRIBED.

Having, in the former section, pointed out at some length the defects of the common method of rearing the oak, I now proceed to lay before my readers a sketch of a system which I have myself invented, and which, from experience, I venture to recommend as is entirely free from the defects in question.

When land is to be planted with oaks, the first care of the proprietor ought always to be to provide shelter. To effect this, the ground must be well filled with Scots firs or larches, or, what is still better, with a proportion of both. The Scots firs ought to be two, and the larches either one or two, years old at the time of planting, which operation ought to be performed on the notching system already described; this being both the cheapest and most expeditious way of executing the work. The ground is to be fenced, and receive whatever other previous preparation it may require, according to the direc-

tions laid down in chapter sixth, every thing being conducted as if the Scots firs and larches were to be the principal or only crops. The plants are to be put in at the distance of four feet from each other, so that four thousand of them will be required for a Scots acre, and the expense will amount to from 15s. to 20s. for that extent of land. Care must be taken to leave regular avenues of the kind already described through the plantation. No oaks, or rather no acorns, are to be planted, until the Scots firs and larches have risen to the height of about four feet from the ground, when they will be in a condition to afford complete shelter to every thing lower than themselves. To attain that size, they will require from four to seven years, according to the quality of the soil.

The practice of planting nurses, as they are called, to afford shelter to oak, has sometimes been adopted even in the old system; but generally on a plan essentially different from that now recommended. Instead of the nurses being planted several years before the oaks, it has been common to plant them at the same time. By this means, the oaks have no efficient shelter for several seasons; and, during that period, they receive so much damage as to have the effect of impeding their growth for many years, even

after the nurses have attained a size to be of service to them. But, by not planting the oaks till the Scots firs and larches are tall enough to yield mi- mediate shelter, the plants will be protected from the very first, not only from the violence of the winds, but from the still more injurious frosts, which often prevail late in spring, and early in autumn, destroying incipient vegetation at the one season, and killing the unripened shoots at the other.

The manner in which the nurses will screen the young oaks from the force of the winds, will be easily understood by every reader; but it may not appear so evident how the frosts, which fall perpendicularly downwards, can be warded off by the same means. To explain this, it may be necessary to state, that the deleterious effects of spring and autumnal frosts, arise chiefly from the leaves being subjected to a sudden change of temperature, from the freezing chill of the night to the strong heat of the rays of the morning sun. When the thaw takes place gradually, the injury done is comparatively insignificant. Several undoubted proofs of this can be adduced. Agriculturists have found by long experience, that their crops are never so much hurt by frost, when the sun rises clouded, and rain succeeds, as when the night is followed by a morn-

ing of bright sunshine. And it always holds good, that corn which is shaded from the first rays by wood or otherwise, is never so much injured as that in other parts of the same field. The late Reverend Dr Skene Keith, in his Agricultural Survey of Aberdeenshire, recommends that, in situations much exposed to autumnal frosts, belts of trees should be planted along the east side of the field, to ward off the early rays of the sun. "In many cases," says that writer, "the rays of the morning sun may be with propriety excluded, by a belt of plantation in the east. For though these are friendly to an early harvest, yet in an unfavourable or late season, if a mildew or rain in the evening be succeeded by frost at night, and if the sun dart his rays in the morning on the wet corn, when in flower, or on the peas, beans or potatoes, before they are fully ripe, the effects are generally fatal. The only remedy, namely, that of two persons going very early with a rope, between the furrows of a ridge, and shaking off the rain or dews, cannot be practised on a large scale; though it may save the potato crop of the industrious cottager to know this, and put it in practice, when he sees the hoar-frost in the morning. A more permanent remedy is to have a small belt of planting on the east, to prevent the sun's rays from

injuring the crop, which is usually dry before the sun appears in the south-east; for the danger is over as soon as the moisture of the night is dried up."—(*Agricultural Survey of Aberdeenshire.*)

If we wish, then, to preserve oaks from frost, we can do nothing better than shade them from the morning sun. This we cannot do more effectually than by planting them, as above directed, among trees that have already made some progress. By such management, the rays of the sun will not touch them till he has risen a considerable height above the horizon, and thus time will be allowed for the frost to dissipate, and the night-damps to evaporate, by a slow and gradual process, so that the pernicious consequences arising to the young oaks from a sudden change of temperature, will be entirely prevented. It is not too much to say, that a plantation of young oaks thus sheltered from the outset will make more progress in five than an unsheltered one will do in ten years.

The plan here proposed may at first sight seem objectionable, on account of the expense; but a little reflection will demonstrate, that a proprietor, instead of incurring loss by pursuing it, will realise a very considerable profit. Two thousand of the Scots firs and larches may be allowed to remain, not

only without injury, but with advantage to the oaks, till they are sixteen years old. One-half of them being then cut down, they will be worth at an average at least twopence each, for spars, paling, &c. Of the remaining thousand, one-half will require to be cut at twenty-five years old, when they will be fit for roofs to cottages, and similar purposes, and will be worth, on the most moderate calculation, one shilling a piece. The last five hundred may be allowed to grow till they are from thirty to thirty-five years old, and will be then so much increased in size, and ameliorated in quality, as to bring from two to five shillings each. To plant nurses, therefore, is attended with very great pecuniary advantage. It will not only return the whole expense laid out in making the plantation, but produce a very high rent for the land during the first thirty or thirty-five years; whereas, if oaks alone were planted, nothing could be gained during this period except by cutting them down, when between twenty and twenty-five years old, for the sake of their bark.

When Scots firs and larches are planted purposely as nurses for oak, it would be a mere loss of time to delay in planting the latter, after the former have risen to the height of four feet, because they will then afford complete shelter both from the winds and

frosts. For the sake, however, of those who have plantations of these trees in a state of farther advancement, it is proper to remark, that the oaks will answer whatever be the height of the nurses, provided their branches have not become so close as to shut out the air from above. This can always be remedied by thinning, an operation which a plantation, in this state, always requires for its own sake, independently of other considerations.

Some places occur which afford natural shelter. Such, for example, are deep ravines, valleys surrounded by high mountains, and the steep banks of rivulets and streams. In situations of this kind, oaks may be planted successfully without being at the trouble of first rearing other trees to nurse them. A deep cover of furze or broom makes likewise an excellent shelter, till the young trees are so far advanced as to be a safeguard to one another. The planting of oak on ground so covered is a practice much to be recommended.

Having said thus much on shelter, I now proceed to discuss the method of planting, or, to speak more correctly, of sowing; for, in order to avoid the fatal consequences of transplantation, the *seeds* or *acorns* are to be put into the ground instead of young plants. For the reception of the *acorns* then, let

the following preparations be made:—Mark off a patch of two feet square, notch it round with the spade, and trench it a foot deep, using an earth-pick or mattock if the hardness of the ground require it, and throwing out all large stones. Proceed in this manner till the requisite number of patches be formed, letting them be about ten feet distance from one another, by which means there will be a few more than five hundred of them in the superfices of a Scots acre. In land which is very stony, it will be sometimes impracticable to make the distances between them completely regular; but this is a matter of little importance, provided the inequalities be not great, and nearly balance each other; where possible, however, it is proper that exact regularity be observed. When Scots firs and larches have been purposely raised on the ground for shelter, they will occasionally interfere with the distance between the patches. When this happens, the inconvenience may always be obviated by rooting up a single plant; but let the expedient be adopted as seldom as possible, for if the nurses be only of the height above specified, there will not be the slightest necessity for thinning them, in order to admit the air. Whatever be the age of the plantation, if the patches be not overshadowed by the lower tier of branches, the

trees are, as far as regards planting oaks among them, sufficiently thin. This may be laid down as a rule which has no exception. In making these patches among furze or broom, no more of either should be cut than is absolutely necessary to make room for working the spade.

The patches being prepared, the next labour will be to plant the acorns. Before proceeding to this, get some lime in readiness, slake it thoroughly with water, in the same manner as is customary when it is to be used for agricultural purposes, and spread as much of it as can be lifted on a common spade upon each patch. Then dig it in, neatly levelling the ground. As soon as a patch is thus prepared, plant in it five acorns, one as nearly as possible in the centre, and the other four forming a square of a foot each side around it, and cover them an inch deep with earth. Proceed thus till the whole be planted. To avoid deception from bad acorns, put them in small quantities, before they are used, into a tub of water. All of them that are sound will sink to the bottom, the others will swim on the surface, and are to be skimmed off and rejected. I recommend five to be put into each patch, because that is the most that will find room for two years without being too much crowded; for though one plant only will be

ultimately required, it is necessary to make provision against the ravages of mice, which being very fond of acorns, will devour many of them in the interval between the time of sowing and that of coming up. Besides, accidents may happen to the young plants, which are easily broken when they newly appear above ground, and the hares will in all probability injure some of them the first and second winters, by stripping off the bark from their tender branches. As a safeguard against all these casualties, it is proper to plant as many acorns in each square or patch as can conveniently grow for the first two years. The cost of the acorns is so trifling, that the waste of them hereby incurred hardly deserves notice.

The most proper season for sowing them is the last week of March, or beginning of April. They may, indeed, be put into the ground in February; but, by this, nothing is to be gained, as, in this country, there is little vegetation before April; and when seeds lie long in the ground before they germinate, they are liable to rot or be otherwise injured. The earlier, too, that acorns are sown, the more they are exposed to the depredations of mice.

The lime which I have directed to be put upon the patches, is not to be considered as an absolutely

indispensable ingredient in this method of planting, but the expense of it is so trifling (as a boll of unslaked lime will serve an acre), and it adds so much to the growth of the plants, that there is a very great advantage in using it. This manure, indeed, imparts no new strength to the soil, but it quickens it, brings its latent powers into action, and has a very great effect in accelerating vegetation. It is peculiarly favourable to young trees, of every description, by swelling and opening the land, it thereby makes way for the young fibres, and enables them to collect and decompose the nourishment, which is naturally inherent in the soil. Here it may be necessary to remark, that it is not advisable to use dung for this purpose. It operates in a manner quite different from lime, imparting a positive nourishment of its own, which is very different both in strength and quality from what is naturally contained in the land, especially in such land as that in which wood is commonly raised. It is this that forms the objection against applying it to oaks. The plants would subsist on it as long as its strength remained, and grow luxuriantly, but that strength being exhausted, they would have henceforth to live on a much poorer and quite different kind of nourishment; so that, in the end, they would be pre-

cisely in the same circumstances as if they had been first raised in the nursery, and then transported into barren land, a change that is always attended with very fatal effects. Lime, therefore, which may be said to act negatively, as it imparts no new source of vegetation, but merely resuscitates the native powers of the soil, which lie dormant, is the only manure that can with propriety be given. It assists the plants, when young, to collect from the ground precisely the same kind of nourishment which, after their roots are become stronger, they will be able to seek for themselves. There are situations, however, in which it would be impossible to procure lime; in such, the acorns may be planted without it, though this should only be done in cases of absolute necessity.

In plantations where regular avenues have been left, the lime can easily be laid down, so as to create little trouble in its distribution. It should be emptied here and there in cart loads, within these avenues, the sod being pared off from the surface of the ground, in the necessary places, to prevent any loss in taking it up. A broad shallow tub, or an ebb-square box, made for the purpose, and placed on a hand-barrow, is then to be used by two labourers, for transporting the lime to its final destination.

They are to take it from the tub or box in spade-fulls, and spread it carefully on the patches. If the cart loads can be emptied in situations tolerably convenient, two workmen will lime 3000 patches, or as many as six acres contain, in a day; or if they dig in the lime as it is laid on, they will prepare 1000, or as many as are contained in two acres, for the reception of the acorns in the same time.

When the acorns are planted, they will give no more trouble for two years. At the end of that period, it is likely that in most of the patches, after all accidents, more than a single plant will remain. It will, therefore, be necessary to go over them, taking away all the supernumeraries. If there be a plant from the acorn that was planted in the centre, it ought to be left, if equally thriving with the rest; but it is not to be preferred if any of the others are bigger or more healthy. The utmost care must be taken, that the plant which is spared have not its roots injured, or in the least degree slackened by removing its companions. The best method of executing the work, therefore, will be by means of a knife, made for the purpose, with a long haft. The blade of this instrument is to be thrust down close by the side of the plants to be removed, and their roots cut two or three inches below the surface of

the ground. They may be then pulled up by the hand without the least injury to those that remain, which would not be the case were a spade or any large tool used to slacken them. Cutting above the surface would not answer, as the plants would grow anew; so that the operation, instead of being finished at once, would require to be repeated every year. The method I have recommended will, of course, render the plants taken up useless; but this is of no importance, if it is admitted, according to what has been said, that oaks ought never to be transplanted, but raised wherever they are required immediately from acorns. One man will be able to clear away all the unnecessary plants in the manner here proposed, from several acres in a day.

At the same time that this work is performed, notice must be taken that the nurses have in no instance extended their branches so far, since the oaks were planted, as to interfere with the latter. Wherever this is the case, the offending tree, whether Scots fir or larch, must be immediately cut down. This is to be done as often as is necessary, which will not be above once every two or three years. It has been already stated that, if the lower tier of branches does not touch nor overshadow the oaks, there is no use for thinning, as more air than

can thus have access would rather check the growth of the plants than do them good. If this rule is observed, all the Scots firs and larches that will require to be taken out before they are sixteen years old, will not render the plantation thinner than a thriving one of the same kind of trees would, for its own sake, need to be at twenty years after planting.

When the oaks are five years old, it will be time to give them their first pruning. As the way in which that process should be executed is fully detailed under the article bearing the same name, it is unnecessary to enlarge upon it here, farther than to observe that the operation ought to be repeated once every two years, till the oaks be between twenty and thirty years old.

Thus have I endeavoured to describe as briefly, but, at the same time, as perspicuously as possible, my method of raising the oak. Of its efficacy, the experiments I have made (an account of which shall be, in the next section, laid before the reader), have left no doubt on my mind. I am firmly established in the conviction, that whoever puts the above directions in practice upon any soil that will bear a good crop of Scots firs or of larches, will find the oak not more difficult to rear, and very little slower in growth, than either of those hardy kinds of trees.

In the present mode of cultivating it, the person who plants scarce ever lives to see it arrive at a bulk large enough to render its timber useful for any of the purposes for which oak is required; but let it be treated according to the above directions, and in thirty or thirty-five years after the acorn is put into the ground, the tree will be in a state of maturity to qualify it,—not perhaps for becoming the principal timbers of a large ship,—but at least for boat-building, and all the lighter and more minute parts of naval architecture.

There is another advantage not to be overlooked, which this way of planting oaks has above the common or old system, namely, cheapness. To say nothing of the Scots firs and larches planted as nurses, which, as we have already seen, will, at no very distant period, return a considerable profit, the most expensive part of the process is the trenching of the patches or squares. As, however, only 500 of them are required in an acre (this number being amply sufficient in a mode of planting where there is no danger of the plants failing after they appear above ground), the expense, for that extent, will not exceed nine shillings, if the ground is not more than usually stony; that is, at the rate of one shilling and threepence per fall; and the same measure of

barren land is often trenched as low as a shilling. The expense of the lime for an acre will be about three shillings, of the acorns one shilling, and of the planting, including spreading and digging in of the lime, about three shillings more; so that the total expense will not exceed sixteen shillings per acre. This must be allowed to be remarkably cheap, compared with the common way of planting in pits. Oaks planted in this way, without nurses, and many of them liable to go back from the effects of transplantation, cannot, with propriety, be kept at a greater distance from one another than four, or, at most, four feet and a half. Between 3000 and 4000 of them, therefore, will be required for every acre; and if they are, as they should be, at least five years old, and have been transplanted in the nursery, the price will not fall short of two pounds per thousand. Here is an expense of from six to eight pounds per acre, for plants alone, besides the cost of making the pits and of planting the oaks, which together, will fall little short of twenty shillings more. The expense of planting oaks on the plan now proposed and explained, is, therefore, in no higher a ratio to that of the common system, than one to nine; that is, an acre of land can be planted with acorns at one ninth part of the expense at which the same extent can

be planted with 3000 oaks five years old. This calculation, too, is made in round numbers, which renders the difference of the ratio considerably less than it would be by reckoning the fraction.

By adopting certain modifications in the manner of planting the acorns, the expense of the process may be rendered still lower than that stated above. Instead of trenching the patches, and making them two feet square, they may be only dug so deep as is practicable on account of stones, and their area reduced to a square foot, or one fourth part of the dimensions which have been formerly recommended. The cost will thus be reduced in the ratio of five or six to one, and still the system will be attended with far greater success than can be attained by pursuing the method of which we have so often had occasion to speak in terms of disapprobation. Such modifications, however, will deprive the system of many of its advantages, and ten times the money that they save in the outset will be ultimately lost.

SECTION IV.

ACCOUNT OF EXPERIMENTS ILLUSTRATIVE OF THE ADVANTAGES OF THE METHOD OF RAISING OAK, EXPLAINED IN THE FOREGOING SECTION.

THE first of these experiments was attended with the following circumstances and results, and was made in the year 1821.

A considerable extent of waste land had been planted in 1810, with larches, Scots firs, and oaks; two thousand of the first two kinds, and as many of the last having been allowed to the Scots acre. The oaks had been treated exactly in the common mode. The soil being of rather a favourable quality, the Scots firs and larches had, at eleven years of age, that is to say in 1821, attained a considerable height, and exhibited a remarkably thriving appearance. The oaks were in a very different state. A great number of them had entirely disappeared, and the remainder were scarcely two feet taller than at the time they had been planted, and appeared very weak and sickly. As is usual on such occasions, the soil was blamed, and considered incapable of

producing oak. As I had formed an opinion before this period, that failures of oak plantations proceeded, in general, rather from the badness of the culture than the soil, I now determined to prove the truth or falsehood of my surmises by an experiment. In the month of January, I trenched, within this plantation, four patches or beds, each three feet long by two feet broad. Two of the beds were limed, the others received no kind of manure. I then procured some acorns, as well as some seedling oaks, from a nursery in Aberdeen. Two of the beds, one limed and one unlimed, I planted with acorns; the other two, one of which was likewise limed and one unlimed, I planted with seedling oaks. This experiment was calculated to decide two things; the effects of liming, and the comparative merits of transplanting, or of raising immediately from the acorn. At the end of the first summer, the transplanted oaks had made, as usual, very little progress, either in the limed or unlimed bed, but the former seemed to be in a healthier condition than the latter. The seedlings raised from the acorns were in both cases very fine plants; but in them the good effects of the lime were abundantly evident, those in the limed bed being stouter, as well as taller, than those in the other. Next summer the

four beds exhibited as many different degrees of forwardness. The plants from the acorns in the limed bed had some of them made shoots of eighteen inches long; the largest growths made by those in the other bed were several inches shorter; the transplanted oaks in the limed bed had not grown half so much as the last mentioned, but were perceptibly before their brethren that had received no manure. The most forward of the transplanted oaks, therefore, though they had a year's advantage in age, were now far behind the most backward of the others.

Having sown the acorns too thick, it was necessary, in order to carry on the experiment, to thin them when they were two years old. This I accordingly did, leaving only four of the best plants in each bed. Though the transplanted ones, from their having grown less than the others, were not too much crowded, yet to give them equal justice, so that there might be nothing doubtful in their final result, I thinned them out to the same distances. The third summer exhibited the same respective differences in the growth of the plants, as the preceding one had done. Of those raised in their present situation from acorns, the limed ones grew most; those in the unlimed bed were next in order; the limed transplanted were third in the

scale; and the last place was held by the transplanted ones, in the bed which had received no lime. The summer of 1825 was the last in which I had an opportunity of attending to the growth of these plants. They were then five years old, and the difference of progress which had been made each year, by the plants in the respective beds, rendered the diversity of their size palpable and striking. The oaks raised from acorns in the limed bed exceeded the height of those which had been raised in the same manner, but without lime, a full foot, and were as tall as ever I remember to have seen Scots firs of the same age. The plants in the unlimed acorn-bed were on an average eighteen inches taller than the most forward transplanted ones, namely those to which lime had been applied; and these last were from six to eight inches further forward than the transplanted ones which had not had the advantage of manure. I observed, however, with regard to those which had made the least progress, that they were farther advanced than any I had ever seen treated in a similar manner in other respects, but without the benefit of shelter.

This experiment was, as I have already said, begun in the year 1821. In order to avoid interruption, I have, as yet, taken no notice of three subse-

indispensable ingredient in this method of planting, but the expense of it is so trifling (as a boll of unslaked lime will serve an acre), and it adds so much to the growth of the plants, that there is a very great advantage in using it. This manure, indeed, imparts no new strength to the soil, but it quickens it, brings its latent powers into action, and has a very great effect in accelerating vegetation. It is peculiarly favourable to young trees, of every description, by swelling and opening the land, it thereby makes way for the young fibres, and enables them to collect and decompose the nourishment, which is naturally inherent in the soil. Here it may be necessary to remark, that it is not advisable to use dung for this purpose. It operates in a manner quite different from lime, imparting a positive nourishment of its own, which is very different both in strength and quality from what is naturally contained in the land, especially in such land as that in which wood is commonly raised. It is this that forms the objection against applying it to oaks. The plants would subsist on it as long as its strength remained, and grow luxuriantly, but that strength being exhausted, they would have henceforth to live on a much poorer and quite different kind of nourishment; so that, in the end, they would be pre-

cisely in the same circumstances as if they had been first raised in the nursery, and then transported into barren land, a change that is always attended with very fatal effects. Lime, therefore, which may be said to act negatively, as it imparts no new source of vegetation, but merely resuscitates the native powers of the soil, which lie dormant, is the only manure that can with propriety be given. It assists the plants, when young, to collect from the ground precisely the same kind of nourishment which, after their roots are become stronger, they will be able to seek for themselves. There are situations, however, in which it would be impossible to procure lime; in such, the acorns may be planted without it, though this should only be done in cases of absolute necessity.

In plantations where regular avenues have been left, the lime can easily be laid down, so as to create little trouble in its distribution. It should be emptied here and there in cart loads, within these avenues, the sod being pared off from the surface of the ground, in the necessary places, to prevent any loss in taking it up. A broad shallow tub, or an ebb-square box, made for the purpose, and placed on a hand-barrow, is then to be used by two labourers, for transporting the lime to its final destination.

having on his estate a piece of ground entirely overgrown with luxuriant furze, determined to plant it with oaks. By way of preparing the ground for the reception of the plants, he ordered the furze to be rooted out and carried away. About five-sixths of the land was thus actually cleared, but the remainder was still in its original state, when the planters overtook the labourers employed in removing the furze. The spring being far advanced, it was judged inexpedient to stop the planting, till the latter had completed their job, and the uncleared part of the ground was accordingly planted like the other. When I examined this plantation, I found that many of the oaks had gone back throughout the whole of it, but that more of them comparatively had done so where the whins had been allowed to remain, than where they had been grubbed up and carried away. This was, no doubt, caused by the planters having found their work more difficult to execute in the thick cover, than on the open ground, and therefore performing it in a less perfect manner, in order to complete a stated quantity in a given time. But however this may be, the surviving plants among the whins, where they had been protected from the winds and frosts at the first outset, were much farther advanced than those where the

cover had been destroyed. I measured a number of each carefully, and found that the former had, on an average, grown three times as much as the latter. Nor was there the least ground for ascribing this disparity to any difference in the quality of the soil; for I examined it, and found it of the same nature throughout the whole piece of ground. There, in fact, appeared to be no cause of the superiority of the one over the other, but the shelter afforded by the whins which had not been destroyed.

I hasten to conclude this section, by observing, that the principal features of the plan of rearing oak I have been recommending, are countenanced by no less respectable authority than that of Nature herself. We have already had occasion to prove, that, in ancient times, this tree grew plentifully in Scotland, and we are certain that our old forests were never planted by the hands of man. Our ancestors, five hundred or a thousand years ago, had acquired no taste for making improvements; and a feudal chieftain of those ages would have been as easily persuaded to relinquish any of his personal or hereditary feuds, as to plant trees on his estate. But, if the ancient oak forests of Scotland were natural, as it is allowed on all hands they were, we are sure that every tree of them grew to maturity

in the identical spot where the acorn, from which it sprung, first germinated; for, though Nature often sows, she transplants none. She never provides one place for the tender plant, and another for the full grown tree; her nursery and woodland are the same. To raise oaks, therefore, immediately from the acorns, in the places where they are intended to come to maturity, instead of transplanting them from the nursery, is merely to imitate Nature. And, whatever may be said with regard to the primeval, or first oaks, that grew in Scotland, which were probably decayed before the country began to be peopled, we are sure that their descendants,—those gigantic trees which furnished materials for our ancient Gothic buildings, and those which still remain entire, though prostrate, in our peat-mosses and bogs,—sprung up amidst the depth of surrounding woods, where they were completely sheltered, from the time they first appeared above ground, till their towering height had surmounted all the humbler and more ignoble tribes of the forest.

SECTION V.

DIRECTIONS FOR REARING SUCCESSION CROPS OF OAK, AND FOR THE RECOVERY OF YOUNG OAKS IN A SICKLY OR UNTHRIVING CONDITION.

If five hundred oaks are planted in an acre, in the manner which has been recommended, they will require to be thinned after the nurses are cut down; for in a tolerably favourable soil, not more than one hundred will have room to come to full maturity in this extent of ground. General directions for thinning are given at another place; but the importance of the oak, as well as certain traits in its nature peculiar to itself, will require a few remarks on the process in relation to it individually. Before proceeding to these, however, it may be as well to anticipate an objection which might here be put by the reader in some such form as the following: "Since, if we plant five hundred oaks in an acre, they will afterwards require to be thinned, till only one hundred are left, would it not be better to plant only the last-mentioned quantity, and thus save a considerable share both of trouble and expense?"

In answer to this, it may be remarked, that five hundred will have sufficient room on an acre, till the trees be worth on an average 10s. or 12s. each. Suppose, then, that the first thinning takes place when the trees are of this value, and that a hundred of them are cut down to give scope to the rest, their price will amount to L. 50, a sum in comparison of which the expense of planting, pruning, and felling them, dwindles into nothing. At each successive thinning, the trees will be greatly increased in value, so that by the time they are reduced to the number which will have room to come to full maturity, a very considerable sum will be realised. This, it is evident, would not be the case, were only one hundred, the number supposed capable of reaching their full growth, originally planted. It is true that, in the last mentioned circumstances, the nurses, or part of them, might be allowed to stand longer, but that would be less gainful, because an oak that grows well, will, from the superior value of its wood and bark, be worth more when forty or fifty years old, than a Scots fir or larch raised on the same soil of equal age. " But, if this is the case, why limit the number of oaks to five hundred per acre? Might we not plant a thousand, or fifteen hundred, and thus derive a still greater profit from the plan-

tation?" We cannot, it is replied, plant the oaks much thicker than is above specified, without being under the necessity not only of clearing away the nurses at an age when they will be of little value, but of thinning the oaks themselves before they have attained a marketable size. The same oak, if felled at thirty, will scarce bring the fourth part of the price which it will do if it is allowed to grow till it be fifty years old, supposing it to continue in a thriving state till that time. These remarks, it is hoped, will sufficiently explain my views, and save me from the charge of caprice, in recommending that five hundred oaks be planted on an acre. After bestowing considerable attention on the subject, I think it would be productive of loss to plant either many more or many fewer. It is but fair, however, to allow, that, on this point, my opinion is founded rather on careful calculation than on actual experience.

But to return from this digression, I remarked a little above, that it would be requisite to say a few words on the process of thinning, as it applies to oak, in addition to what is elsewhere said on that subject, in reference to wood in general. These supplementary directions will relate to the mechanical part of the operation merely, and they are ren-

dered necessary from the importance of not injuring the roots of an oak in cutting down the trunk of the tree.

An oak plantation may, with proper care, be made to renew itself as often as it is cut down. The roots, or stools as they are sometimes termed, which remain in the ground, will, if they are preserved from the effects of bad treatment, send forth a young progeny of shoots, which may be trained into a new race of trees as valuable as the former. The growth of these may, however, be greatly impeded, or even entirely prevented, if the roots be considerably shaken, if the bark be stripped off them, or if the stump or stool be left in such a state as to lodge water. In thinning oak, therefore, the forester should always have an eye to the succession crop, and adopt such means as will injure the roots the least possible.

In cutting down an oak-tree, the saw should always be used in preference to the axe. The last-mentioned instrument has not only a tendency to shake and loosen the roots, by the repeated and violent percussion which is necessary in working it, but in using it, the most expert woodman can hardly avoid leaving a hollow in the middle of the stool. This hollow retains all the rain that falls into it, and rottenness is produced as a matter of course.

Even in working the saw, when the tree is cut partly from the one side, and partly from the other, a hollow is sometimes left. Against this, the workmen should be put upon their guard, and directed to avoid it as much as possible. Before felling an oak, the bark near the ground is sometimes peeled off, in order to prevent any loss of that article. When this is performed in a careless or unskilful manner, great injury may be done to the root, an evil which will be prevented by taking any sharp instrument, such as a large knife, and cutting quite through the bark, all round the tree, and as near the earth as possible. Between the bark of the trunk and that of the roots a separation will thus be formed, so that none of the latter will be stripped off in removing the former. Without this precaution, the bark of the roots might be separated from the wood, several inches below the surface, to the great injury of the stool.

When all the trees which the state of the plantation requires to be removed are cut down, it will be advisable, that the stools may be the better secured against the deleterious effects of wet, to daub them over with paint, containing a good quantity of oil. Special care should be taken in applying this composition, not to neglect the edge of the stool,

four beds exhibited as many different degrees of forwardness. The plants from the acorns in the limed bed had some of them made shoots of eighteen inches long: the largest growths made by those in the other bed were several inches shorter; the transplanted oaks in the limed bed had not grown half so much as the last mentioned, but were perceptibly before their brethren that had received no manure. The most forward of the transplanted oaks, therefore, though they had a year's advantage in age, were now far behind the most backward of the others.

Having sown the acorns too thick, it was necessary, in order to carry on the experiment, to thin them when they were two years old. This I accordingly did, leaving only four of the best plants in each bed. Though the transplanted ones, from their having grown less than the others, were not too much crowded, yet to give them equal justice, so that there might be nothing doubtful in their final result, I thinned them out to the same distances. The third summer exhibited the same respective differences in the growth of the plants, as the preceding one had done. Of those raised in their present situation from acorns, the limed ones grew most; those in the unlimed bed were next in order; the limed transplanted were third in the

scale; and the last place was held by the transplanted ones, in the bed which had received no lime. The summer of 1825 was the last in which I had an opportunity of attending to the growth of these plants. They were then five years old, and the difference of progress which had been made each year, by the plants in the respective beds, rendered the diversity of their size palpable and striking. The oaks raised from acorns in the limed bed exceeded the height of those which had been raised in the same manner, but without lime, a full foot, and were as tall as ever I remember to have seen Scots firs of the same age. The plants in the unlimed acorn-bed were on an average eighteen inches taller than the most forward transplanted ones, namely those to which lime had been applied; and these last were from six to eight inches further forward than the transplanted ones which had not had the advantage of manure. I observed, however, with regard to those which had made the least progress, that they were farther advanced than any I had ever seen treated in a similar manner in other respects, but without the benefit of shelter.

This experiment was, as I have already said, begun in the year 1821. In order to avoid interruption, I have, as yet, taken no notice of three subse-

quent experiments, conducted on precisely similar principles, and begun respectively in the years 1822, 1823, and 1824. The results of these corresponded exactly with the above. The oaks raised from acorns got the start of the transplanted ones the second year, in every instance; and, so long as I had an opportunity of observing them, added to the superiority thus acquired, each succeeding season. The lime, too, had the same salutary effects as in the first experiment.

I have laid these results before the reader, not only for the sake of convincing him, that, in the innovations I have proposed, I have not been under the guidance of vague and uncertain theory, but to point out to him an easy way of putting the merits of these innovations to the proof. Any person who wishes to have ocular demonstration of the truth of what I have advanced, before he ventures to put my plan in execution, on a large scale, may repeat my experiments at the expense of a few shillings, and a very moderate share of trouble.

There is, however, one peculiarity of my system, which the foregoing experiments do not illustrate. I have not only directed that the oak should be raised immediately from the acorn, without the intervention of transplanting, and that lime should be

applied to promote its early growth, but that care should be taken to provide it with shelter from the very first, to protect it, when young, from the rigour of the winds and frosts. The experiments I have mentioned were all performed in fir plantations of a considerable age, so that they furnish no data by which to judge of the comparative progress of oaks, in and out of shelter. At the time of making them, I had no opportunity of trying similar ones in open ground; nor did I deem this of much consequence, as observation had, long before, convinced me, that shelter has a very powerful effect in promoting the growth of wood of every kind; and that nothing is more prejudicial to the growth of trees in general than much exposure. With regard to the oak, in particular, the fact, that its young shoots are extremely apt to be injured by spring and autumnal frosts and mildews, is sufficient of itself to justify the assertion, that, to afford this tree shelter when young, is a powerful means of accelerating its progress. Lest, however, any of my readers should require some specific illustration of the point, I shall adduce an example, which fell under my notice several years ago, and which has all the force of an experiment purposely made. Nine or ten years before the period to which I allude, a gentleman,

having on his estate a piece of ground entirely overgrown with luxuriant furze, determined to plant it with oaks. By way of preparing the ground for the reception of the plants, he ordered the furze to be rooted out and carried away. About five-sixths of the land was thus actually cleared, but the remainder was still in its original state, when the planters overtook the labourers employed in removing the furze. The spring being far advanced, it was judged inexpedient to stop the planting, till the latter had completed their job, and the uncleared part of the ground was accordingly planted like the other. When I examined this plantation, I found that many of the oaks had gone back throughout the whole of it, but that more of them comparatively had done so where the whins had been allowed to remain, than where they had been grubbed up and carried away. This was, no doubt, caused by the planters having found their work more difficult to execute in the thick cover, than on the open ground, and therefore performing it in a less perfect manner, in order to complete a stated quantity in a given time. But however this may be, the surviving plants among the whins, where they had been protected from the winds and frosts at the first outset, were much farther advanced than those where the

cover had been destroyed. I measured a number of each carefully, and found that the former had, on an average, grown three times as much as the latter. Nor was there the least ground for ascribing this disparity to any difference in the quality of the soil; for I examined it, and found it of the same nature throughout the whole piece of ground. There, in fact, appeared to be no cause of the superiority of the one over the other, but the shelter afforded by the whins which had not been destroyed.

I hasten to conclude this section, by observing, that the principal features of the plan of rearing oak I have been recommending, are countenanced by no less respectable authority than that of Nature herself. We have already had occasion to prove, that, in ancient times, this tree grew plentifully in Scotland, and we are certain that our old forests were never planted by the hands of man. Our ancestors, five hundred or a thousand years ago, had acquired no taste for making improvements; and a feudal chieftain of those ages would have been as easily persuaded to relinquish any of his personal or hereditary feuds, as to plant trees on his estate. But, if the ancient oak forests of Scotland were natural, as it is allowed on all hands they were, we are sure that every tree of them grew to maturity

where the wood and the bark meet, as the water getting between them is particularly pernicious. Some foresters (and their practice is worthy of being imitated) give the stools the following *dressing*, as it is technically termed: They take an adze, and pare off the edge of the stool in a sloping direction, all round, and as close as possible to the ground. This gives the stool a rounded figure, and thereby prevents water from lodging on its top. In working with the adze, the stroke must be given upwards, and none but persons that are expert at handling that tool ought to be employed, otherwise the stools will be much disfigured, and the process so imperfectly performed as to do harm instead of good. If, in addition to such a dressing, paint be likewise applied, injury from moisture will be still more effectually prevented.

The stools will require no farther attention for two or three years, by which time they will have sent forth a number of shoots, some of which will be a considerable length. These must now be thinned out, leaving from four to six of the best, according to the strength of the stool. In order to perform this work effectually, it will be necessary to prepare a chisel with a pretty strong wooden handle or haft, about two feet long, and also a wooden mallet.

With these tools the workman is to proceed thus: Let him bend down the shoots which are to be taken away, and place his foot upon them, to leave both hands at liberty. Let him then place the chisel close to the place where they are joined to the parent stock, and strike its head with the mallet till the shoots are displaced. I know of no method which is so safe and expeditious as this, and which, at the same time, does the work so effectually. If an axe or bill be used, it will be extremely difficult, even with the greatest care, to avoid injuring either the shoots that are to be left, the parent stock, or both. Another objection to the use of the last-mentioned instruments is, that, with them, it is for the most part next to impossible to cut off the shoots close by the roots; and if this is not done, a multitude of young suckers will spring from the parts left, and double the labour at some future period. At the same time that the superfluous shoots are removed, the rest should be carefully pruned.

The number of shoots here directed to be left will, if they are designed for coppice, require no more thinning; but if it is intended that a new crop of timber be reared, it will afterwards be necessary to displace them gradually. The reader may here be ready to ask, Why not do the work at once, and

save the trouble of future repetitions of the process? There are several reasons which render this ineligible. If, at so early a stage of growth, only one shoot were left on each stool, it would not be able to consume the sap furnished by the roots. The consequence would be a multitude of new shoots springing up, which would require to be displaced in their turn; so that no labour would ultimately be saved. When the shoots are young, they are exposed to a variety of accidents, being, especially, very liable to be broken, and it is highly proper that some provision should be made against such casualties. In addition to these considerations, it is worthy of notice that, among several shoots which have made equal progress, and appear equally thriving when they are two or three years old, there may be a considerable inequality, in both respects, some years afterwards. Besides the other conveniences, therefore, of leaving a plurality on each stool, at the first thinning, the practice gives an opportunity of selecting for preservation, at a period when the vegetative powers of the shoots are more fully developed, the individual which has the appearance of becoming the finest tree; this appearance being the less deceptive the farther the plant has advanced in growth. I neglected, in the proper place, to observe, that, at

the first thinning, the shoots should be left at as regular distances from one another as possible round the whole circumference of the stool.

Pruning will require to be performed once every two years, as in a common plantation; and the forester must exercise his own judgment in thinning by degrees, as may be found necessary, till the number of stools and young trees be equal. As soon as one of the latter appears capable of exhausting all the nourishment that one of the former can supply, it is time for this equality to take place; but the precise period cannot be stated, as it will vary under different circumstances, and can be determined solely by the state of the plantation in each particular case. Whenever the *wavers*, (as the shoots put forth by oak-stools and regularly trained with the view of letting them grow to the size of timber are sometimes called), become so thick as to exclude a proper supply of air, and consequently draw each other up weak, they must of course be thinned, without regard to what number the stools may be capable of nourishing.

Some writers tell us that a single stool will be able to bring several shoots to the size of trees, and recommend that more than one shoot be accordingly left. That the fact is true, in certain cases, not only of

the oak, but of the ash, elm, beech, plane, and several other species, is undeniable; but of the propriety of the direction founded upon it, if it be intended as a general rule, there is great reason to doubt. When we see several large trunks springing from one common root, it is generally in detached situations, where there is ample scope for the spreading of the branches on all sides. Even in these circumstances, it is somewhat problematical whether such a plurality of stems be more advantageous to the proprietor than a single one would have been; for we can easily conceive that the deficiency in number might have been fully compensated by superior size and quickness of growth. At all events, common sense teaches, that it is only when a stool stands alone and by itself, not when it is in the near vicinity of others, that the attempt to make it bring more than one bole to maturity can at all deserve approbation.

The above directions, with the exception that the whole number of shoots left at first is to be allowed to remain, without farther thinning, are applicable, though the crop be not intended for timber but coppice. Coppice is chiefly valuable on account of its bark, for the sake of which it is cut every twenty, twenty-five, or thirty years, according to the quick-

ness or slowness of its growth. It would be desirable that coppice, as well as grown timber, should be cut down with the saw instead of the axe; but to this, the length of time that would be required in performing the work, is reckoned an insuperable objection. And it must be confessed, that the use of the axe is productive of less damage in cutting down coppice than in felling large trees; because the comparatively few strokes that are requisite in the former case have evidently a less tendency to disturb the roots, than the long and vehement percussion which is necessary in the latter. The stumps should be all left of a sloping figure, in order that the water may run off; and the less they rise above the surface of the ground so much the better. The young shoots which are to form the succeeding crop often spring from the highest part of the stool; and if this is many inches above the surface, several evils ensue. In the *first* place, the shoots, having no connexion with the ground, cannot put forth roots, as they always do when they spring, like the suckers which we sometimes see about growing trees, from the part of the stool which is in immediate contact with the soil. They have, therefore, a less copious supply of nourishment than they would have in the last-mentioned circumstances; and, consequently,

make less progress in growing. *Secondly*, if coppice has been repeatedly cut, and the stumps left of a considerable length each time, the stools not only become greatly disfigured, but no new roots being formed, the old ones grow weak with age, and at last totally decay. *Thirdly*, When shoots spring out from the old stool, at the distance of several inches from the ground, they are very liable to be broken off by great falls of snow, and a variety of other causes, which have comparatively little power over them when they strike root in the earth. These considerations, in addition to that of preserving the stool from the deleterious effects of moisture, render it highly eligible to give the stumps of coppices the same dressing after each cutting as has just been recommended for stools after a fall of grown timber. The expense, if skilful workmen are employed, will be trifling: but even should it prove considerable, it will be ten times repaid by the salutary effects which it will produce.

A great and general error in the management of oak coppice, is the utter carelessness which prevails of affording it shelter during the first years of its growth. At this early stage, the shoots from an old stool are as apt to be injured by the winds and frosts as those of a young plant. By exposing them un-

protected to these enemies, therefore, very great loss is incurred: yet, from the manner in which coppice is generally dealt with, the managers and proprietors of woods seem to be utterly regardless of this evil. The whole is cut down on the return of the stated period, at one fell swoop, without leaving a single twig that might help to ward off the blighting blasts from the ensuing crop. The ugly appearance of a *hag*, as it is termed, left in this revolting state of absolute nudity, might of itself be a sufficient inducement to leave some straggling bushes of coppice here and there by way of clothing, to hide such an uncomely sight in some degree from the eye. But in this, as well as in other departments of the forester's duty, the old mode has been adhered to, in many instances, even although erroneous in the view of those who practise it, from an indolence which cannot rouse itself so far as to change its ancient habits, or attempt improvement.

An oak coppice may be kept continually under shelter by adopting the following very simple plan: Instead of proceeding as with a field of grass to be made into hay, and laying all flat before us; if we leave standing as much of the coppice as will shade the stools, whose produce is cut down, from the rays of the morning sun, the rising shoots will have

abundant shelter from the effects whether of winds or frosts. As soon as these shoots are of sufficient height to shelter one another, the nurses may be cut down; their stools will be sheltered in their turn by the young crop which has just got up around them; and thus the whole will have the advantage of uninterrupted protection from the injuries of the weather.

Coppice is generally sold on the ground, and is cut down by the purchaser; and it may therefore be objected that the mode of proceeding just explained, would be productive of much vexation and inconvenience. That it would occasion, at least the first time it was put in practice, some degree of trouble, is readily confessed; but the difficulties connected with it bear so small a proportion to its advantages, as to form no just ground of rejecting it and persevering in the common plan. There is surely nothing insurmountable in counting the number of stools contained in any given extent of coppice, or in making the buyer aware how many of these the proprietor wishes to be saved from the axe. An intending purchaser on being told that the produce of one-eighth, one-ninth, one-tenth, or any other proportion of the stools, was to be left standing for the purpose of shelter, would know as well what he

would be safe to offer, as if the whole were put up to sale. The stools intended to be spared could be marked by the simple expedient of turning up a sod beside each, which would be a sufficient guide to those employed in cutting, while it would be a check on the purchaser to prevent him from encroaching on the proprietor's right, by taking more of the coppice than he bargained for, or from leaving only the produce of inferior stools, instead of a fair average of good and bad. These hints are given, not as describing the best possible method of accomplishing the object in question, but to show that the scheme is practicable, and that it involves no difficulty which may not be surmounted by a very moderate share of ingenuity and attention.

In a coppice which has been once cut on the above mentioned system, there can be no recurrence of similar inconveniences on any future occasion. The young crop, from the stools whose former produce was cut down at the return of the stated period, will require the aid of the nurses till it is five or six, or perhaps eight or nine years old. When these nurses are cut down, therefore, the new crop of coppice that arises from the stools will be so far behind the rest in growth as to be easily distinguished, without the aid of any artificial mark to show that it is not

to be cut down. The purchaser will be under no temptation to exchange any of it for the maturer produce of the stools which actually belong to him; or if he do, it is impossible that the proprietor can be a loser; and the number of the nursing-stools, as we may call them, being ascertained and mentioned in the articles of sale, it will be easy to discover whether any fraudulent liberties are taken with them; or in other words, whether the purchaser cuts down more of the crop than he is entitled to by the conditions of his bargain.

If, after what has been said, the reader should still persist in thinking the scheme here proposed impracticable, or at least too troublesome to be adopted, he may have recourse to various other modes of accomplishing the object now under consideration. A coppice of small extent may be sufficiently sheltered by surrounding it with a thickly planted belt of any kind or kinds of trees adapted to the soil. In larger grounds, birch and mountain-ash may be planted at proper distances throughout the whole. These should be encouraged to grow rather in the shape of bushes than trees, which they may be made to do by heading them down when they are two or three feet high, and letting the young shoots which will afterwards spring up, grow

without pruning. Both these trees are extremely hardy, will grow in any soil where they can be required for the purpose in question; and if planted twelve or fourteen years before the fall of a coppice, will be of sufficient height to protect the ensuing crop. When the bushes grow to a cumbersome size they may be cut down, observing to do this when the coppice is tall enough to afford shelter to itself; but, at the same time, so long before the period at which it will be fit for the axe, that the suckers which arise from the roots of the birch and mountain-ash may be so far advanced as to qualify them for nursing the next progeny of the oak stools.

In most old coppice grounds there is abundance of materials for shelter, that have grown up naturally among the stools, consisting (besides the kinds which we have recommended when it is necessary to plant for this purpose) of willow, alder, and, in some cases, ash and plane-tree. The general practice is to cut these down along with the coppice, so that no benefit is ever derived from them as nurses. This conduct is the more reprehensible as the pecuniary advantage derived from it is exceedingly trifling, and scarce worthy of notice. The proprietor would find it far more profitable to reserve all the *barren* wood (as in a coppice every other species besides the

oak is termed) and let it stand for shelter. Sometimes, indeed, it grows so thick as to be destructive instead of salutary: when this happens, it must, of course, be thinned to the requisite distances; and to prevent the too frequent recurrence of that labour, all the unnecessary roots should be grubbed up or destroyed. In concluding this subject, I do not hesitate to assert, that, by means of shelter, the growth of coppice may be so materially accelerated as to add permanently twenty per cent. to its value.

The last thing proposed to be done, in this somewhat miscellaneous chapter, was to throw out a few hints for the recovery of oak plantations in a sickly or unthriving condition. It has been already mentioned, as a frequent consequence of the common mode of planting oaks, that they become stunted, and remain for years without making any progress. The roots, being first injured by transplanting, require several seasons to re-establish their vigour, and enable them to convey a due quantity of sap to the branches. During this interval, the latter become hide-bound, their vessels contract, and they lose the power of drawing the supply of nourishment requisite for their growth, after the roots are capable of affording it. The superabundant sap must, of course, have a vent: but finding none in the origi-

nal and natural channels, it disgorges itself by forming tufts of insignificant shoots all over the stem of the plant; as the humours of the human body sometimes break out in blotches on the skin. Thus an irregular scraggy bush is gradually formed, which it is beyond the art of the most skilful pruner to train up into any semblance of a proper tree. The only certain cure for oaks in this state is to head them down within an inch of the ground. The knife is a fit instrument to perform this work, if the stem is not above two inches in circumference; but when the girth exceeds this, a small saw, made for the purpose, should be used. In applying the knife, a considerable pull is requisite, which will have a tendency to disturb the roots, if they are not well fixed in the earth. In heading down oaks, therefore, that have only been planted a few seasons, the operator should place a foot on each side of the stem, and as near it as is consistent with the use of the knife, that the roots may be kept firm by his weight.

I recollect no instance in which the above treatment did not prove salutary. The cutting down of the plant leaves no room for the sap to waste itself, as formerly, in the production of a multitude of insignificant twigs. It is concentrated in a single point; and the consequence is, that a healthy, vigorous and

thriving shoot springs up, so that the plant may be said to receive a new nature; and it is henceforth as remarkable for quickness as it previously was for slowness of growth. Any person who has a young plantation of oaks in a stunted condition, if he doubts the efficacy of the mode of cure here suggested, and is afraid to hazard its consequences on a large scale, may, to avoid all risk, first try its effects on a few plants. The result of the experiment will, I have no doubt, convince him that my assertions are well founded and true.

In plantations where thinning has been neglected, we often meet with oaks drawn up as tall and slender as hop-poles by the trees among which they grow. In such circumstances, it is in vain to expect that they will ever become valuable timber; and the proper way of dealing with them is to cut them down as directed above, clearing away, at the same time, as many of the neighbouring trees as may be necessary for the free admission of air. I have known instances, where this plan has been followed, of the stools sending forth shoots four feet long in one season. The proper time for heading down oaks is between the fall of the leaf and the period at which the sap begins to ascend, that is, from January to March.

When oaks formerly in a thriving state seem to become hide-bound, it is often of use to slit the outer bark with the point of a very sharp knife from top to bottom of the trunk, and along the principal branches. Care must be taken in making the incision to keep the blade in such a position as to cut through the outer bark, without piercing the inner bark or liber *. If the tree is pretty large, several of these longitudinal slits may be made at equal distances from one another in its stem; but the bark must by no means be cut in a cross or transverse direction.

I once recovered several old oaks, whose tops were considerably advanced in decay, by the following simple process: I laid lime on the surface, all round the trees, and to the distance of several feet from their stems, and dug it in as deep as was practicable without injuring the roots. This was done in the month of February, and the following summer such a profusion of young shoots were put forth as to hide from view every withered branch. Lime seems indeed to be very salutary in reviving deciduous trees of every description; and I believe I have

* In Vol. iv. Part ii. p. 395. of Memoirs of Caledonian Horticultural Society, a slitter or scarificator is described and figured, which by a simple contrivance prevents the possibility of cutting too deep, or running the knife between the outer and inner bark.

the merit of being the first to make this public *. A more perfect way of applying it than the above, would perhaps be, to lay the roots of the tree bare, and place it in contact with them, after having first mixed it with twenty times its bulk of fresh mould.

* I allow this to stand as it was first written, though, since reading Sir Henry Steuart's work on giving immediate effect to Wood, I am convinced that the preparation which he applies to such trees as do not appear to thrive after removal, would have a much more powerful effect than the simple application recommended at the place to which this note refers. This preparation consists of a mixture of earth and coal-ashes; and his manner of applying it, the reader will find described towards the end of the account of his method given in this volume. I cannot avoid thinking that those who have plantations in parks or pleasure-grounds in an unthriving state, from badness of soil or such-like cause, would find the most gratifying effects to succeed a skilful application of more than one of Sir Henry's composts. Some of these are very cheap, and the most expensive of them, which is the one here referred to, given at the rate of three or four cart loads to each tree, could be applied to several thousand trees for a comparatively trifling sum.

Query, Might not those who have already plantations about their mansions, but of a diminutive size, from badness of soil or otherwise, rapidly produce all the improvement they could desire, by a judicious use of Sir Henry's composts, without adopting any more of his plan?

CHAPTER IX.

PLANTS PROPER FOR UNDERWOOD, AND THEIR CULTURE.

UNDERWOOD may be considered under three views; as it improves the beauty of a plantation; as it contributes to the increase and preservation of game; and as it may be rendered productive of pecuniary profit.

When a plantation has risen to a considerable height, and the lower branches have been removed, either by pruning or natural decay, the trunks, utterly devoid of any kind of foliage, have a bleak and disagreeable appearance to a spectator who is either within the wood or near it. This is more particularly the case when the trees belong to any of the fir tribe; for the straight, formal manner in which they grow, has a tendency to remind the beholder of posts for drying linen standing on a bleaching-green, or of the pillars in the frame-work of a saw-pit, objects that are far from being either picturesque or beautiful.

To remove the unpleasing effect of a plantation in such a state, recourse must be had to underwood; by means of which a subordinate verdure may be produced, to relieve the eye from the tiresome sameness of a multitude of naked stems, and to render the view of a forest, when we are close by its side, or in the midst of it, scarce less enchanting than when placed at a distance: the sight rests on its branches, which conceal all deformities by their umbrage, while they nod in the summer breeze. Underwood, for the sake of ornament, is particularly requisite on the outskirts of a plantation, and along the verges of the walks or rides which may have been formed through it.

One of the plants which may be properly used for the purpose in question is the Mountain-ash. It is extremely hardy, will thrive almost in any soil, and succeed well beneath the shade of larger trees. Its blossom in spring, and its berries in autumn, are extremely pleasing to the eye, and render it highly ornamental. When planted for underwood, it should be taken from the nursery before it exceeds two feet in height, and pits should be made for its reception. A cheaper way of propagating it, is to sow its berries in the plantation where it is wanted, as soon as they are gathered from the trees. Though the sur-

face of the ground be covered with a considerable depth of grass or fog, as many of them will find their way to the soil as will produce a sufficiently thick crop. Most berries lie two years in the ground before they germinate; but of those of the mountain-ash a considerable number spring up the first season. When propagated for underwood this tree should never be pruned. There is an objection against its admission into plantations, which, when they are situated in the neighbourhood of towns or villages, is of some weight. The tempting appearance of its berries in autumn encourages the inroads of schoolboys, a kind of depredators that are very injurious to woods.

The Birch, both weeping and common, may also be introduced as underwood, even in situations where ornament is the principal object. For though it carries neither showy flower nor berry, its leaves are not destitute of beauty, and theyemit an odour which most people find highly agreeable in taking a walk through a forest. If the herbage on the surface of the ground be not very deep, the best way of raising birch for the purpose in question, is to sow its seeds in the month of April.

Several of the hardier kinds of shrubs, whose cultivation is generally confined to the parterre, may

be used with great success to adorn the woodland. One of these is the common purple Lilac, which is easily propagated, very hardy, grows well under the shade of trees, and is by no means delicate with regard to soil. This shrub may be planted at any time, from November to March, and should be from two to three feet high when removed from the nursery. Twenty or thirty plants of it put into rich garden soil will, in the course of a few years, furnish as many suckers or offsets as will be sufficient for a considerable extent of woodland. In the latter it is not necessary to plant the lilac very thick, for it has a great tendency to increase, and one set will soon fill the ground with its suckers to a considerable distance all around it. It is its prolific nature that renders it peculiarly valuable for dwarf underwood; as by means of it the bare appearance which is so offensive to the eye in grown wood may be remedied quickly, and at a trifling expense. When in bloom, it looks extremely gay; and though its commonness takes away from its effect when we see it in a garden or shrubbery, nothing can be better calculated for enlivening the gloom and loneliness of a forest. The lilac should be planted in pits, and the offsets should not be too much divided.

The dwarf Laburnum is another species well qua-

lified for beautifying forest scenery. It is very hardy, grows well under the drip of large trees, and almost any soil will suit it. It may be planted in pits when two or three years old, any time from November to March. If any of the plants appear to be sickly the first summer after they are planted, they should be headed down the following spring within two inches of the ground. This will make them grow up bushy, a property very desirable in underwood. Four or five years after planting, the laburnum will begin to blossom. Its large clusters of bright yellow flowers have an extremely cheerful aspect in the deep solitude of a wood.

The Sweet-briar is another very ornamental plant, though of more humble growth than the last. It is likewise a flowering shrub, bearing a rose in July, the fruit of which is a large dark red berry that hangs upon and beautifies the bush during the greater part of the winter. The leaves of the sweet-briar have a very agreeable smell, and when wet with the morning or evening dews, or with rain, they fill the air with their sweetness. Three or four years may be allowed to the sweet-briar in the nursery, in which it should be once transplanted before removing it to adorn the forest. It should be planted in pits, its branches being first shortened to two inches

in length, and the extremities cut from its roots. The more bushy the plants are, so much the better. But perhaps the best way of propagating this shrub in plantations, is to sow its seeds where wanted, instead of using plants from the nursery. Having collected a sufficient quantity of its heps, when they are fully ripe about Christmas, lay them in a heap, and cover them with earth till the end of March, when they are to be taken up, and the seeds cleared of the pulp. Sow them as follows: Make round patches by paring off the surface as thinly as possible, about a foot in diameter, throwing away the sod. Turn over one stamp in the centre, and drop in a few of the seeds, covering them about a quarter of an inch deep. Proceed in this way till as many are sown as is deemed necessary, and leave them to take their chance. Though all the seeds should grow, it is not necessary to thin the plants. One or two in each patch will get the start of the rest, and make room for themselves. By following this plan, thousands of sweet-briar bushes may be raised wherever they are wanted, at a very trifling expense. Even the wild briars, as they bear roses and berries, are not void of beauty, and may be encouraged to grow among wood. To propagate them, no more pains need be taken than to scat-

ter seeds on the ground, and leave them to their fate.

The Common Hawthorn is rendered classical by our national poetry and songs, and while in blossom is one of the most beautiful large shrubs we possess. Where the purpose is ornament, it may, with great propriety, be introduced as underwood in the outskirts of a plantation where there is a south or south-west exposure; but it scarcely flowers in situations where it is much shaded from the sun. It may be planted in pits when two or three years old, its shoots being previously shortened, as was directed for those of the sweet-briar. It may also be propagated from seeds in the same manner as the last mentioned plant; but the haws should be kept in a heap covered with earth for twelve months after they are gathered, as none of them germinate till they have been two years in the ground. The proper season for sowing them is from December to March. The growth of hawthorn may be greatly accelerated by the application of lime.

In order to make the forest as cheerful as possible during the winter months, every sort of evergreen that is hardy enough for the purpose, should be introduced among the underwood. Of this kind of plants none deserves higher regard than the common

Holly. It is at once the hardiest and most beautiful of evergreens, is originally a native of our climate, and has, from time immemorial, been a favourite with our poets, who have, in all ages, been fond of introducing it among the imagery which they draw from woodland scenery. The holly delights in shady situations, and in a light soil which is not subject to run dry in summer. It will, however, succeed well enough in stiff land which has not a superabundance of moisture. Being a tap-rooted plant, it does not like transplanting, and the older it grows, the worse that operation agrees with it. It is necessary, therefore, that the plants be taken very young from the nursery, and the proper season for removing them, like most other evergreens, is the month of September, or latter end of August. Patches of a foot diameter should be made for them by carefully digging the ground; and three or four plants should be pricked into each as a provision against failures. By far the best way, however, of propagating the holly in plantations, is to sow its seeds in patches like those we have recommended for acorns, but they need not be above half as large. Drop into each of these a few of the berries, or rather of the seeds, after the pulp is consumed by being buried in the earth a year previously. They should be

covered with earth between a quarter and half an inch deep. If the whole of the seeds grow, the plants may nevertheless be left without thinning, as some or other of them will get the start of the rest, and make room for themselves.

The Juniper is an evergreen which ought by no means to be despised in ornamenting forest scenery. It will grow in a considerable degree of shade, and is easily propagated. In many of our woods and waste lands, indeed, it grows naturally; but when this is not the case, it may be raised by scattering its berries on the ground where it is wanted.

The Yew is very handsome, and no evergreen is more celebrated. Though it grows to the size of a tree, it may be made to fill the subordinate place of underwood, as it thrives extremely well in the shade. Its berries may be sown as directed for those of the holly, or plants of it, five or six years old, may be procured from the nursery. It is perhaps the slowest grower of all the trees that are natives of this country. We must be cautious of planting yew in places to which cattle have access, as it is to them a deadly poison.

There are two climbing or running plants, which may be made to supply the place of shrub-evergreens, and are highly ornamental. These are the

Ivy and Periwinkle. The former, however, can only be introduced with safety into a plantation, so far as to cover a stone-fence, or the bare face of a rock; for if permitted to climb up the trees, it will do them very great injury. It is a pity this should be so; for few objects are more picturesque than the trunk of a large tree verdant with ivy. The periwinkle is chiefly useful for covering the surface of the ground, and though it will climb over earth, or even stone-fences, in a shady situation, it does not ascend trees, and is therefore quite harmless. Its deep-green leaves make a fine contrast with its azure-coloured flowers. It may be propagated from plants put into the ground either in spring or autumn. These are easily procured, readily strike root, and a few of them will soon increase, so as to cover a large space of ground *.

The Woodbine or Honeysuckle is another climbing plant which possesses a high degree of beauty. It is apt to injure young trees, by winding itself tightly

* I would recommend the introduction of the large-leaved or Irish ivy, and the large-leaved periwinkle, both of which are more splendid and showy than the common kinds, and may be propagated with equal ease. I have also lately introduced the Privet into woods, and I find it succeed well. It is a fine ornamental plant, its light green leaves forming a pleasant contrast with the darker colours of the ivy.

round them ; but it is far less dangerous in this respect than the ivy, as it neither strikes root in the bark, nor excludes the air and retains the damp at all seasons of the year, like the last-named plant. In old woods it may be introduced with perfect safety, as the damage it occasions to a full grown tree is scarce worth notice. It indeed prefers running on the ground to ascending a tree of any considerable girth ; for being strongly attracted by the sun, though a twig of it placed on the north side, or shaded side of a trunk, will inevitably make a circuit round, so far as may enable it to bask in the noon-tide rays of that luminary, there is no charm to excite it to a counter revolution, and none but small stems, accordingly, of which the shaded part, when the sun shines, is extremely narrow, are in danger of suffering from the too close embraces of the woodbine. Honeysuckle may be propagated either from berries or slips. The latter should be a foot long, and of the preceding year's growth. The fittest season for planting them is the month of February, and they must be inserted in the ground deep enough to cover at least one joint.

Some of these plants cannot, perhaps, in strict propriety, be denominated *underwood ;* and I may be blamed for introducing matter inconsistent with the

professed design of the present chapter. I cannot, however, resist the temptation of mentioning some others, which are well calculated for beautifying a plantation, though they may appear still more remote from the purpose in hand than any I have yet noticed.

Many of the hardier species of flowers, both bulbous and fibrous rooted, which in general are cultivated only in the garden or pleasure-ground, may be introduced with excellent effect as ornaments to the forest. Of these, all the common varieties of the Cowslip and Primrose, will grow wherever trees are found in a thriving state. These simple flowers blow early in spring, and are in full perfection when the grassy sod on which they recline has just assumed its vernal hue. Nothing can be more enticing than their appearance at this early season of the year, or contribute more to render a stroll in the woods delightful. They sometimes spring up naturally, especially by the sides of running streams; but as their plants are easily procured, they may, at little more expense than is incurred by putting them into the ground, be propagated in any plantation where this is not the case. They will hold, if transplanted, at almost any season of the year, when the drought is not excessive, or when the earth is not hardened with frost.

The Narcissus, both yellow and white, is likewise excellently adapted for the same purpose. The leaves are of themselves ornamental, and the flowers seem still more beautiful, when we see them in a wood, than in a garden, where their commonness detracts considerably from their effect. The bulbs of the narcissus should be planted in the month of October, not singly, but in pretty large clusters, and covered about an inch deep with earth. The Snow-drop, Star of Bethlehem, large Turncap Lily, and Crocus, are all bulbous plants, that may be removed to the forest as companions to the narcissus in October.

The common perennial or Kamschatka Lupine, one of the most ornamental of the hardier kinds of flowers, may be introduced as successfully as any into woods. It may be propagated either by seeds, cuttings, or offsets; but the last method is to be preferred as the readiest, and as being attended with the least trouble. Half a dozen of plants of it, will, in a few years, increase to thousands, without the slightest attention on the part of the gardener. Its roots are so prolific in sending forth young plants, that in the pleasure-ground it is often necessary to dig many of them up, and consign them, like weeds, to the dunghil;

though on its first introduction into the north of Scotland, it was so highly valued as to be sold by the nurserymen at half-a-crown the plant. The perennial lupine may be transplanted at any season when it is not in flower. When removed to the forest, its roots ought not to be weakened by too much dividing, for the sake of multiplying plants.

The Bachelor's Button, Monk's-hood, Campanula, and a variety of other flowers equally common and hardy, will thrive as well in the forest as in the best cultivated garden; and they all appear more beautiful when we meet with them in the wilderness, than when we see them in the most trimly-kept parterre.

A number of plants which are usually classed among weeds, and are sedulously extirpated wherever they are found in cultivated land, possess no inconsiderable share of beauty, and were they rare exotics, would be as carefully cherished as they are now unsparingly destroyed. Such are the broom, the various species of fern, the wild foxglove, &c. Even of the thistle, that sturdiest of all weeds, there are species, which, when in flower, have an imposing appearance, and, however I may be laughed at for the assertion, there are few objects to be met with in natural scenery more romantic than a large heal-

thy plant of this proscribed genus in full bloom, the wild bees buzzing in delight around it, or alighting to extract its honey. The plants, indeed, which we consider as weeds, whatever natural charms they may possess, offend the eye when we see them growing in a garden, or amidst cultivated fields, because they are then associated in our minds with the noxious effects they have on the crop. But when they fall under our notice in places which are beyond the province of the plough or the spade, such as the moor or the forest, where there is nothing in their vicinity to which they can be productive of harm, all our prejudices against them vanish, and our eyes become open to their beauty. At the risk, therefore, of exciting the mirth of many a knowing forester at my own expense, I recommend the above mentioned weeds, as well as all others which have any thing agreeable, either in the shape and verdure of their leaves, or hue of their flowers, as highly proper for adorning woodland. Weeds though they be, nature has not planted them indiscriminately in every place, and a little pains and attention might be worse expended than in propagating them, when we wish to add beauty to a plantation.

Most of the plants now mentioned will be proper, though the principal object be not ornament, but

the increase and preservation of game. Underwood planted with a view to this object, should possess the requisites of affording concealment and shelter, and of rendering the interior of a forest difficult of access, at the hours when poachers usually commit their depredations. For the sake, likewise, of attracting a variety of birds, which, though not reckoned game, every person of taste will encourage to frequent his plantations (such, for instance, as the ring-dove, the thrush, the blackbird, the goldfinch, the linnet, and others), it is desirable that underwood consist as much as possible of plants which bear seeds or berries proper for the food of these birds. Now, almost the whole of the plants mentioned above possess some of these properties, part of them all. The lilac affords, by the multitude of suckers which it throws out in all directions, no contemptible cover. The creeping woodbine and periwinkle, by ever and anon entangling the feet, render the traversing of a wood after sunset an enterprise far from expeditious, and not without danger of many a sudden fall. The mountain-ash, besides serving the purposes of concealment and shelter, produces plentiful crops of berries for the subsistence of various kinds of birds, and the tender bark of its young shoots is fed on by the hare, when that

animal is forced from the open fields by deep falls of snow. The holly, the hawthorn, and the briar, possess all the properties that can be required in underwood; they produce berries, afford shelter, and, of all the natives of the forest, are the most effectual barriers against the midnight inroads of the poacher, as they wound and tear whoever comes unwarily in contact with them. Even the flower plants which have been enumerated, bear seeds from which some or other of the flying tribes derive part of their livelihood. The thistle itself, which retains its downy seeds during the winter months, furnishes the greater part of the goldfinch's subsistence throughout that portion of the year. Thus we find, that we cannot plant underwood with a view to ornament, without at the same time making provision for the encouragement and protection of game, and of such other animals as almost every proprietor will consider desirable inhabitants of his plantations.

When the principal object is, however, to increase and preserve game, there are several other kinds of plants which may with great advantage be intermixed with the foregoing. Of these the Hazel deserves particularly to be cultivated, wherever the soil is favourable to it. This plant may either be raised in the nursery, and removed to its final destination,

professed design of the present chapter. I cannot, however, resist the temptation of mentioning some others, which are well calculated for beautifying a plantation, though they may appear still more remote from the purpose in hand than any I have yet noticed.

Many of the hardier species of flowers, both bulbous and fibrous rooted, which in general are cultivated only in the garden or pleasure-ground, may be introduced with excellent effect as ornaments to the forest. Of these, all the common varieties of the Cowslip and Primrose, will grow wherever trees are found in a thriving state. These simple flowers blow early in spring, and are in full perfection when the grassy sod on which they recline has just assumed its vernal hue. Nothing can be more enticing than their appearance at this early season of the year, or contribute more to render a stroll in the woods delightful. They sometimes spring up naturally, especially by the sides of running streams; but as their plants are easily procured, they may, at little more expense than is incurred by putting them into the ground, be propagated in any plantation where this is not the case. They will hold, if transplanted, at almost any season of the year, when the drought is not excessive, or when the earth is not hardened with frost.

ering is a simple and easy process. It consists in bending the branch down to the earth, and fixing it with a hooked peg of wood at any place where there is an *eye*, as it is technically termed; that is, wherever a twig springs out from the main branch.

If there are several of these twigs here and there on the branch, it may be pegged into the earth as often as they occur, according to the distance at which we wish the plants that grow from them to stand from one another. At the end of two years after layering, several shoots of a considerable length will have arisen from each eye. Some of these may then be laid down in their turn, and by proceeding thus, as often as an opportunity occurs, acres of land may in time be planted, if that is necessary, from one original stool. If the branch to be laid is very strong, it may be saved from the danger of breaking, by cutting it half through, near the root, and then splitting it up, for the space of a foot or more. This will render it less stubborn to bend, and consequently diminish the risk of fracture. The surface of the ground should be pared off at the place where the branch is to be pegged down, and the earth slackened. As much of the branches as touches the soil must be covered with mould, at least three inches thick, and well pressed down

with the foot. After being sufficiently rooted, the young plants may have their communication with the parent removed, by cutting away the part of the branches laid down which joins them. As a defence against poachers, however, it will be prudent to let this remain, as it forms a snare, that, if set in a sufficient number of places, will render the forest impassable from sunset till broad day light return. For the branches or shoots being pegged down as before described, the parts of them not covered with earth will be like the springs of so many mole traps; and to walk among them at night, without being in danger of falling at every step, is obviously impossible. There is scarce any sort of tree or shrub which may not be propagated by layers as easily as the oak or the hazel, and all who wish to make their plantations secure haunts for game, would do well to reduce this hint to practice on an extensive scale.

The wild Raspberry forms no despicable cover. The hare seems partial to it in making choice of a lair, and in the season of its fruit, it furnishes sustenance for a variety of birds. Nothing that can be planted is more hardy, or comes sooner to perfection, than the wild rasp, and it thrives even where the branches and foliage above it are so thick as to exclude

every ray of the sun. All these properties render it an eligible material for underwood. It may be propagated by sowing its berries as soon as ripe, without any preparation of the ground whatever; but the best way is to procure plants of it, putting them into the ground in pretty large bushes.

The Bramble is an excellent plant for rendering access to a wood difficult; and where it does not grow naturally, it may be propagated by sowing its berries as directed for those of the wild rasp.

When underwood is planted with a view to pecuniary profit by cutting it periodically, it should consist chiefly, if not entirely, of the oak and the hazel. The value of the former will consist in the bark; the latter is always in request for hoops, walking-sticks, &c.

Underwood may likewise be planted with the design of training it up into a succession crop of timber, after the first is cut down. With regard to oak, this is not only practicable, but may be pursued with the greatest advantage. When the old trees are felled and carried off the ground, the oak bushes that formerly served as underwood are to be cut down, and the shoots which subsequently arise from them managed according to the directions in Sect. 5. of the foregoing chapter. A new crop may thus

be reared much sooner than could be done by replanting the ground after the fall of the old wood. It is, of course, only in fir plantations, that the precaution of planting underwood, with a view to a succession crop, can be necessary, as other species renew themselves by the shoots sent forth from their stools.

In conclusion, it may be necessary to remark, that there are many of the shrubs and trees enumerated above as proper for underwood, which it would be unsafe to plant at the same time with the principal crop. The latter must be allowed to make considerable progress, before we venture to introduce materials, which, intended for a subordinate purpose, might take the lead. In a plantation not more than twenty years old, there is no occasion for underwood, either for ornament, or for the sake of game, as the branches then are near enough the ground to prevent the bad effect which is produced by bare lofty stems, and to afford abundant cover for whatever animals frequent the woods. Among trees of that age, but not among younger ones, we may begin with safety to propagate any kind of plants that can contribute to give a forest, in an advanced state of growth, closeness or beauty.

CHAPTER X.

SUCCESSION CROPS OF WOOD.

One of the most arduous tasks which fall in the way of the forester, is the raising of trees upon ground from which old wood has been lately cut down. The difficulty, however, is often ascribed to erroneous causes; such, for instance, as the exhaustion of the soil by the former crop, or the inability of land to raise the same kind of produce twice in succession. As to the soils being exhausted by wood, enough, it is hoped, has been said in our introductory remarks to prove the notion erroneous. Every nurseryman is aware, that the same kind of trees may be raised in the same piece of ground not merely twice, but twenty times, and with the more success, the greater the number of repetitions. The true cause of the difficulty in question seems to be, the roots of the old trees, which, by rendering the ground hollow and open, admit the drought to a great depth, and thereby render it next to impossible for young plants to thrive among them.

The most obvious way of doing away with the above-mentioned evil, would be to pull up all the old roots before replanting the ground. This plan is, however, attended with very considerable expense, and is on that account objectionable. Another way in which the inconvenience may be avoided, is not to plant till the old roots be decayed; but as a period of ten, or perhaps fifteen years, will intervene after the old trees are cut down before that happen, this plan cannot be much recommended. A third method, which may be adopted, is to plant in pits of at least double the size that would be necessary in common ground, taking care to cut so deep as that none of the old roots be left entire at the bottom. Were this plan followed, trees would grow as readily among the undecayed roots of an old plantation, as in any situation whatever. Failures in land of this description, generally arise either from making the pits too small, or from planting on the slitting or notching system, which is entirely inadequate when the ground is interwoven with roots, through which, as through a sieve, every drop of moisture escapes. But by making large pits, all the roots which would otherwise be in close contact with those of the plants are removed to a proper distance, and along with them, that hollowness of

the ground which renders it so perniciously susceptible of admitting drought. In planting firs, and the other kinds which require to be removed from the nursery while they are yet very young, on this plan, the pit should be first filled up, and the young tree afterwards placed in its centre by means of a common garden dibble. I know of no reasonable objection that can be had to this mode of proceeding, but that it will be found expensive.

The readiest, however, as well as the cheapest way of raising a succession crop of wood, is to plant underwood of the proper kind for that purpose, among the old trees, at least 12 or 15 years before it is intended to cut them down, if it has not been done at an earlier period. When the latter are removed, the former will become the principal crop in its turn; and as its roots will already be well established in the ground, it may be trained up into timber with the greatest facility. The method of planting underwood for this purpose, is explained at another place*, and it will be only necessary here to give some directions for its treatment after the old trees are cut down. When this takes place, the underwood will have rather an unpromising appearance. Be-

* Supra, p. 270, &c.

sides its naturally drawn up and scraggy aspect, most of it will have been disfigured by the falling of the trees, and to an inexperienced eye it will seem utterly unsusceptible of ever being brought to any thing superior to brushwood. By proceeding with it, however, according to the following plan, it will soon assume a more favourable appearance. Cut it all down within two or three inches of the ground, with the exception of bushes here and there, which ought to be left for the purpose of shelter. This work should be performed in the winter season, and the following summer strong and healthy shoots will be sent forth. These are afterwards to be thinned and pruned as occasion may require, and the repetition of these processes at proper intervals, will be all the labour necessary to train up these shoots into fine and thriving trees.

These remarks relate to the raising of succession crops of wood when the former crop consisted of firs. Most of the hard-wooded species send forth shoots or suckers from the roots after the trees are cut down; and these suckers may with great facility be trained up into timber. It is singular, that, excepting in the case of the oak alone, scarce any attention should have ever been given to this method of renewing plantations,—especially as a shoot springing

from an old root will grow nearly as fast again as a young plant brought from the nursery.

The elm, ash, plane and beech, to say nothing of the oak, which is treated of by itself, all reproduce themselves in this way, though some of them with less certainty than others. The roots of the elm almost infallibly put forth suckers, whatever age the tree may be when cut down. The same is true of the ash, if it be cut down before it exceeds a hundred, or a hundred and twenty years old. The root of the plane is somewhat more shy than any of the former in putting forth suckers, yet it seldom fails to do so if the tree have not stood more than a century. Last in the scale is the beech, which, indeed, will scarce renew itself from the root if the latter is very old. The birch, alder, willows and poplars, likewise send forth suckers from the roots after the trees are cut down, but these species are of less consideration than those above mentioned.

The treatment which the shoots thus arising from all these varieties require, in order to train them up into trees, is the same as for those of the oak, and the reader is referred to Chapter VIII. Section 5., in which the method of raising succession crops of that tree is explained. It will not, however, be necessary to be at so great pains with

be reared much sooner than could be done by replanting the ground after the fall of the old wood. It is, of course, only in fir plantations, that the precaution of planting underwood, with a view to a succession crop, can be necessary, as other species renew themselves by the shoots sent forth from their stools.

In conclusion, it may be necessary to remark, that there are many of the shrubs and trees enumerated above as proper for underwood, which it would be unsafe to plant at the same time with the principal crop. The latter must be allowed to make considerable progress, before we venture to introduce materials, which, intended for a subordinate purpose, might take the lead. In a plantation not more than twenty years old, there is no occasion for underwood, either for ornament, or for the sake of game, as the branches then are near enough the ground to prevent the bad effect which is produced by bare lofty stems, and to afford abundant cover for whatever animals frequent the woods. Among trees of that age, but not among younger ones, we may begin with safety to propagate any kind of plants that can contribute to give a forest, in an advanced state of growth, closeness or beauty.

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the stools of the varieties now under consideration, immediately after the trees are cut down, as is there recommended. They need not receive any dressing before the shoots make their appearance, care however being taken, in felling the trees, not to peel off the bark of the stools below the surface of the ground. The shoots that arise from them are to be treated precisely as is directed for those of the oak, being thinned out gradually, and pruned as necessity may require.

I have known shoots springing up from the old root of an ash, elm or plane, grow four or five feet in one season. This progress is greater than is usually made by plants of any of these kinds brought from the nursery, for several years after they are placed in their new situation; I must, therefore, repeat, that it is a fact of a very singular nature, that scarce any attempt should have ever been made to renew hard-wood plantations in the manner now described.

When plantations of Scots firs are cut down, if sheep and cattle be excluded, considerable numbers of seedling plants of the Scots fir often make their appearance, from cones which had been shed in former years. These seedlings are found to succeed much better among fresh roots, than such as are tran-

sported thither from the nursery. They should, therefore, be carefully protected, as well on their own account, as that they will serve the purpose of nurses to such plants as it may be necessary to introduce, in order to fill up the ground after the old roots are decayed. This last remark relates chiefly to cases in which no underwood of the proper kinds for being trained up into timber has been planted before the old trees were cut down.

CHAPTER XI.

ACCOUNT OF SIR HENRY STEUART'S METHOD OF GIVING IMMEDIATE EFFECT TO WOOD.

In improving natural landscape by artificial means, nothing is of greater importance than wood, without which, scenery of every kind is destitute of its principal charm. Hence the slowness with which wood, when treated on the common plan, generally arrives at maturity, has ever been matter of lamentation and regret to ornamental planters; and, a great interest consequently attaches to any expedient for producing grown trees in the proper situations, with that degree of celerity which is so desirable in landscape-gardening. The method of transplanting large trees, lately published by Sir Henry Steuart of Allanton, whose operations and improvements in this particular department have been extensive and important, has met with great approbation, and appears to be the best system yet offered to the public, both in a scientific and practical point of view. Sir Henry points out in a clear

and forcible manner, a safe and practicable process, by which grown trees may be removed to any desired situation at a moderate expense, in cases where a proprietor has proper subjects of his own, or can obtain them at a short distance from the spots in which he wishes them placed. It is the design of this chapter to give an account of this method as briefly as is consistent with perspicuity, the reader being referred for more ample details, and, in general, for the scientific principles on which this method is founded, to Sir Henry's own work on the subject, intituled "The Planter's Guide, or a Practical Essay on the best method of giving immediate Effect to Wood."

The practical directions are delivered according to the following arrangement, viz. :—1. Selection of subjects for removal. 2. Preparation of the soil for their reception. 3. Preparation of the trees themselves previous to removal. 4. Taking up and transportation of the trees. 5. Planting of the trees in their new situations. 6. After-management.

Selection of Subjects.

In order that large trees may have a due chance of success when removed, it is necessary that they

should possess the following qualities; *first,* Thickness and induration of bark; *secondly,* Stoutness and girth of stem; *thirdly,* Numerousness of roots and fibres; and, *fourthly,* Extent, balance, and closeness of branches. These Sir Henry Steuart has designated *Protecting Properties,* and the *rationale* which he gives of them is in substance as follows.

Thickness and induration of bark are absolutely necessary for every tree that is to be placed either single, or in a small group, in order to defend its sap-vessels from the injurious effects of cold. This principle is deduced from the circumstance, that Nature, who does nothing in vain, gives to all exposed trees a much denser and harder outer coat than to such as have the advantage of shelter from external objects. Thus, on examining a single or an exposed tree, we always find that its bark exceeds both in thickness and induration that of another of the same age and species, in the heart of a large plantation, where closeness of shelter renders it unnecessary that the tree should be provided with the means of self-protection independently of foreign aid. Hence we may easily see the folly of removing a tree to an open situation, from a closely sheltered one, nature having never qualified it for such a change.

Girth and strength of stem are obviously necessary for such trees as have to stand in open sites, in order that they may be enabled to resist the force of the wind. This, which may be deduced from mechanical principles alone, is amply confirmed by observation, a tree which has been exposed from the first being always much thicker in proportion to its height, than another of the same kind protected from its infancy by the shelter of surrounding objects.

Numerousness of roots and fibres is a property absolutely necessary, whatever be the nature of the exposure into which a large tree may be removed. Roots serve two purposes to vegetables,—they give them stability, and, what is of still greater importance, they supply the nourishment from the earth, without which no vegetation can take place. It is, indeed, highly necessary for the transplantation even of the youngest trees, that they should have good roots; and the necessity must be still greater in aged ones; the removal of which, under the most favourable circumstances, implies no inconsiderable degree of violence.

The fourth qualification required is extent, balance and closeness of branches. The principal mo-

tive which will influence any one to remove an old tree, will be to impart ornament or shelter to some place destitute of wood. But in the extent, balance and closeness of the branches of a tree, both its beauty and its power of affording shelter chiefly consist. Independently, therefore, of any use which the branches may be of to the success of trees when transplanted, there is very strong inducement to select them with the best possible tops, and preserve these tops from all injury and mutilation. It so happens, however, that the branches of a tree are nearly as necessary for its growth as the roots themselves. They carry the leaves, and without the leaves the sap cannot be elaborated so as to become food for the tree. The sap is first extracted from the earth by the roots; it passes from the roots to the stem, and from the stem to the branches, and thence to the leaves, by the sensible and insensible respiration of which, and by communication with the atmosphere, it first becomes fit for the purposes of nutrition. It then gradually circulates back again, feeding in its way, first, the branches; secondly, the stem; and last of all, the roots, which are therefore as much dependent on the branches, as the branches on them. To mutilate the top of

a tree, then, when about to be removed, as was formerly the practice, is one of the surest means for its destruction.

Such being the properties which large trees ought to possess, in order to qualify them for removal, it is plain that large and close plantations are not the places in which the transplanter should look for subjects, whether he intend to plant singly or in groups. We have already seen that the requisite thickness of bark and girth of stem are only to be found in open situations, as shelter is equally unfavourable to both existing in that degree which will enable a tree to be removed into exposure without injury. One of the uses of the bark is to exclude cold from hurting the sap-vessels; now, when a tree grows amidst the shelter of other trees, that shelter in proportion to the cold it wards off, or the heat it confines, renders less necessary the protecting power of the bark, which is reduced in thickness and induration accordingly. What renders a close wood unfavourable to due girth of stem is equally plain. All vegetables tend to grow towards the light, and are attracted by it. But when trees grow close together, this agent is in a manner excluded from reaching them sideways. Their tendency is accordingly upwards,—their stems are tall

in proportion to their girth,—and they send out extremely few side shoots. The last mentioned fact makes them deficient also in another of the protecting properties, namely, extent, balance and closeness of branches. But the branches and roots being relative and co-relative, that is, mutually dependant on each other, it follows that a deficiency in the former implies a like deficiency in the latter. Thus, trees growing together in thick woods or groves, will be found to possess none of the protecting properties, in such a degree as to render them eligible for transplantation; and it is proper to remark here, that Sir Henry Steuart's first experiments were made on trees of this kind; which experiments, as he informs us, succeeded extremely ill. We have, therefore, a practical demonstration of what has now been advanced, independently of theory altogether.

The transplanter of large trees should therefore endeavour to find his subjects, if possible, in situations well exposed to the rigours of the climate. Trees that grow singly are the best; and next to them, in the possession of the protecting properties, such as may be found in single rows, narrow belts, and small clumps. If he cannot command a sufficient number of these, he must have recourse to art,

in order to give to individuals, belonging to larger masses, the qualifications they possess not by nature, and must patiently wait the result of the processes necessary for that purpose. Directions for proceeding in this case will be given below.

Preparation of the Soil.

The composts employed by Sir Henry Steuart, in preparing the soil for the trees, whether in open or in close dispositions of wood, are, *first*, Quicklime recently burnt, mixed with clayey matter for the light land; *secondly*, Mild lime with sandy soil for the aluminous; and, *thirdly*, Quicklime with peat-moss for the loamy. To each of the two soils first-mentioned, he usually gives an addition of about a third part of peat compost, and by procuring the peat in rather an advanced state of decomposition, its speedy preparation is more easily brought about. These composts he makes up generally six months before they be wanted.

In preparing the ground for park planting, the first thing to be done is to mark out with stakes the position of the single and scattered trees, or groups of two, three, or more. Single trees being entirely unconnected with one another in respect to site,

the pits for each of them are prepared separately. For this purpose, if the subsoil be porous, the ground is trenched two feet deep. For a pit of this description three single cart-loads of compost are required, which compost must be as thoroughly mixed with the soil as possible.

Supposing the pit intended to remain empty a year or more after being trenched, the work should proceed as follows:—The compost is first to be laid down round the stake, and at such distance from it, that none of it may be in the area of the pit. The dimensions are then to be marked off, so as to make the pit for a middle sized tree, about eighteen feet diameter. This being done, the trenching is to begin, taking care to wheel the earth taken out of the first trench to the opposite side of the pit, in order to close in the last one. The compost is to be dashed evenly over the surface as the work proceeds, every practicable means being made use of to mix it as thoroughly as possible with the soil.

It is highly advantageous that the trenching should take place at least twelve months before the tree be planted, in order that the compost may have its full effect in promoting the pulverization of the soil. If this, however, should be found inconvenient, and the planters, from impatience, or any other

cause, intend to place the tree in its new site immediately, the following plan is to be adopted :—

In the *first* place, Let the compost, instead of being laid round the circumference of the pit without its area, be piled up in a heap at the centre around the stake. This being done, the workmen are to proceed, not to trench, but to excavate the pit, laying the earth taken out carefully around the edge, and scattering it as little as possible. Over every stratum a spit deep of the earth thrown out, a stratum of the compost at the centre is to be thrown, and when the excavation is finished, the whole mass must be well mixed, by tossing and turning it from the bottom with the spade. These operations being finished, the pit will be ready for the immediate reception of the tree.

Every large tree transplanted should have eighteen inches, or two feet of loose mould. Let it be observed, however, that in making single pits in clayey land, the subsoil should never be pierced. Should this be done, the water at every shower that falls will be contained at the bottom as in a cup, without any possibility of running off, and will prove highly detrimental to the roots of the tree. Any deficiency of soil that may arise from the observation of this rule, must be supplied by bringing

the proper quantity from some other quarter. A few cart-loads will in general serve the purpose, and as it is not requisite that it should be of a particularly fine quality, the planter may procure it without robbing his arable land, by taking advantage of the scourings of ditches, or he may find the necessary supply in glens and hollow places in old plantations, where, if it be dug up in stripes here and there, of the breadth of a spade, and one spit in depth, the removal of it will do no material injury.

The land is to be prepared for groups in a manner similar to that now described, only it is recommended, in this case, to trench the whole of the ground which the group is intended to occupy, instead of leaving unstirred the spaces between the pits. By trenching the whole piece, greater scope is given to the roots, besides that, by pursuing this method, we may penetrate into the subsoil as far as may be necessary to produce the proper depth of mould, and thus save the trouble of bringing earth from a distance, as no water can stagnate where there is no pit to hold it, but where the bottom of the whole being brought to the same level, all superabundant moisture will be drained off.

In preparing the land for close plantations, the

following rules are to be observed. In the end of autumn trench the ground eighteen inches or two feet deep, according as it is of a light or of a stiff quality. During the progress of the trenching, if a manuring of compost can be spared, let it be given as the work proceeds. This, however, though it should be done if possible, is not at this stage of the business absolutely necessary. The ground having received the benefit of the winter frost, after having been dug, is in spring to be well dunged for a potato crop, either with common animal manure, or, what is better, peat-compost made with farm-yard dung, and twice heated and turned. The produce of the crop will, if the process be judiciously executed, more than cover the expense, so that the preparation of ground for close plantations is more economical than for groups or single trees. In autumn, when the potatoes are removed, the ground is in readiness to receive the trees.

Preparation of the Trees for Removal.

The requisites which every large tree should possess in order to fit it for removal, have been already described. We are now to show more particularly, where trees with these qualifications may be found,

and how art may be made to assist nature, in producing such qualifications in subjects where they do not already exist.

The required properties will in general be found in all trees that have grown singly, or in single rows, and have thus been fully exposed to the effects of the weather. This will more especially happen in situations where the soil is light, and of considerable depth, as these circumstances are extremely favourable to the plentiful growth of roots and fibres. Some of the most favourable places for finding subjects with the properties specified in full perfection, are old grass plots, avenues, woodlands near the house or kitchen-garden or the like, where the grass is usually kept under by the scythe.

Trees growing in open exposures, however, have not universally all the protecting properties naturally. They may, for example, have good stems and bark, but they may be found deficient in roots, in branches, or in both, from shallowness of soil, or from mechanical injury sustained from other trees. In this case, we must have recourse to art, in order to assist nature in the production of the qualities which are awanting.

In order to supply deficiency in roots and branches, let about a cart-load and a half of peat-com-

post be taken, or a like quantity of coal-ash, for a tree of the middle size; to which add four or five cart-loads of tolerable mould of an opposite quality, if possible, to that of the ground. These ingredients are to be thoroughly mixed, and raised in a heap around the stem of the tree. They are then to be spread in a sloping direction outwards, to the farthest extent of the roots, keeping them about six inches deep at the extremities, and double that depth at the stem. During the first year after this is done, the fibres of the roots will strike upwards, and pervade the whole mass, and, by this means, both roots and branches will be so materially improved, that in the course of three or four years the tree will become a fit subject for removal.

Should the roots alone be defective, the following easier method may be adopted: let a trench thirty inches wide be opened round the tree, and if you intend it to remain four years, let the distance of this trench from the stem be three feet; or let it be six feet, if you intend to remove the tree at the end of two years, the shortest space that can be allowed between such treatment and transplantation. In the first case, the depth of the trench must at least meet the subsoil, excavating the side next the tree, so as that the roots may in some degree be undermined; or if

the tree happen to be of a tap-rooted species, going down near a foot deeper, and opening a drain to carry off any water which might lodge at the bottom. After this, all that is necessary is to make the earth as fine as it can be broken by the spade, and to return it into the trench, putting what was formerly the surface below the rest, in order to give every facility to the production of fibres. If the tree is to remain only for two years, the same process is to take place, with this difference, that on the south and south-west sides two or three of the strongest roots are to be left uncut, to act as stays against the wind when the tree is transplanted.

So much for the preparation of trees standing singly. We now proceed to give some directions of a similar kind, for those growing in large masses, which, in extensive operations, it will generally be necessary to have recourse to, from not being able to procure a sufficient number of others. The most proper masses of trees for the designs of the planter, are clumps, belts, and groves of no great extent, and from thirty to thirty-five years old. Such parcels of trees Sir Henry Steuart prefers for what he terms a Transplanting Nursery. To prepare them for removal, they should in the first place be gradually

thinned out, so as to admit the full influence of the light and air.

If the planter, however, have access to none of these smaller collections, his only recourse will be to form a nursery out of some ordinary plantation. The best plantation for this purpose will be one of which the mould is friable, and the subsoil dry, these qualifications being necessary for the proper development of the roots. It is farther necessary, that the trees should have been timously and judiciously thinned. A spot of this kind being pitched upon, all such firs as may have served the purpose of nurses, and are not yet removed, are to be cleared away, and all the hard-wood trees that are weak or unsightly grubbed up by the roots.

These preliminaries being finished, the ground is next to be trenched eighteen inches deep, leaving, however, about the trees which will be first ready for removal, about five feet broad untouched with the spade; and two or three roots to each should be left uncut on the stormy side. Three feet in diameter of solid ground, will be enough to leave round the others, two or three of their roots also being left entire as above. During the execution of the work, some tolerable mould, to the depth of a foot near the stem, and not less than six inches at the ex-

tremities of the roots, should be thrown up, to encourage the growth of new fibres. If the nursery be near the verge of the plantation, the two outside rows must be left unthinned, during the first two years, as a protection against the wind. All this work should be executed between November and April.

In the month last named, the whole surface is to be well dunged, either with fermented peat-compost, which is best, or, failing that, with farm-yard manure. The ground should then be cropped with flax, barley or early oats, which, with a crop of hay the following season, will more than cover the expense of the whole operation.

It is proper to notice before leaving this part of the subject, that in a transplanting nursery, the axe and hedge-bill ought to be employed as well as the pick and spade, not indeed to mutilate the trees, but to fashion their tops into such forms, as may be most requisite to render them ornamental. In order to render them tall and spiral, all the lower branches may be cut away, and such others as rival the leading stem. If low and spreading tops be required, on the contrary, the leader should be headed down; and these operations are to be repeated from time to time, till the desired shapes be produced.

Taking up and Transporting of the Trees.

Of all points in the removal of the trees, the most important is the preservation of the roots. If possible, not a fibre should be lost; and the process, therefore, requires not only manual skill, but a very considerable degree of care and patience. The implements to be used in the operation are the spade and the tree-picker. The latter is an instrument resembling a miner's pick, but it has only one prong, which is more inclined to the handle than in the miner's implement. The prong is fifteen inches long, and is made extremely light, as is likewise the handle, which is two feet and a-half long, the joint weight of both being about four and a-half pounds.

Before proceeding to take up a tree, the boundaries of the root must be ascertained. This is easy when the tree has been surrounded by a trench, as the trench will mark the termination of the fibres. In other cases there is greater difficulty, and the extremities of the roots must be sought for with the picker, at least as far from the tree as the branches have extended. The necessary scrutiny being made, and the object of it accomplished, open a trench at the utmost limit of the root, two feet and a half wide, and as deep as the roots have penetrated. The bank must then be undermined on the side where the roots lie, in

order to facilitate the operation of the picker. Two workmen are then to scratch up the roots, while another clears the trench of the earth which they produce. Thus as many workmen may be employed as is found convenient, three and three together in different parts. Every effort must be made to preserve the minutest fibres, and not to bruise or bark any of the larger roots. The pickmen must therefore observe not to strike across the latter, but as much as possible in the line of their elongation, and contriving by a dexterous shake of the instrument, to be acquired only by practice, to make it slip into the spaces between the ramifications, instead of coming down directly upon them.

As the operation proceeds, the roots disengaged must be carefully bundled up, in order to make room for the workmen, as well as to avoid injury from the implement and the feet. When the men have approached within four or five feet of the stem, the process of extrication should cease, and the rest of the earth be left entire, with two or three feet of the original sward adhering to it if possible.

Measures must now be taken to pull down the tree, and get it out of the pit. With this view, let a strong but soft rope, of about four inches in girth, be fixed as near the top as a man can safely climb,

taking care to interpose two or three folds of mat to prevent the bark from being chafed. Seven or eight workmen are then to draw the tree down on one side, or a steady pulling horse may be employed, whose power will have much greater effect. The tree being pulled down so far, is to be held in that position till a foot or more of earth be raised below its roots on the opposite side. Being let go, it will spring up until its roots come in contact with and rest upon this bank. It is then to be pulled down on the other side, and a bank of earth raised as before, and so alternately, till its lowest roots be brought to a level with the mouth of the pit, which, being accomplished, it is ready for transportation. Before proceeding to describe that part of the business, however, we must warn the reader, that if the tree is not to be immediately removed after the roots or part of them are laid bare, that is, if it be to remain where it is but for a single night, a covering of the branches of the spruce or silver fir, with a layer of turf above them, must be applied, to prevent the bad effects of drought or of frost. Either of these would do incalculable injury to the fibres in a very short time; and it is therefore of the greatest importance that the caution now given be carefully attended to.

The transportation is performed by means of a machine made for the purpose, and drawn by horses. This carriage consists of a strong pole, and two wheels running on an iron axle, similar to that of a cart; with a smaller wheel, occasionally used, which is fixed at the extremity of the pole, and turns on a pivot. The third wheel, however, has seldom or never been used by Sir Henry, on account of the extensive injury that it would do to the branches. Accurate directions for constructing different machines of this sort, are given in his Treatise.

The tree being in readiness, the wheels of the machine are to be brought close up to it. This being done, ascertain from the shape of the stem, and the character of the ramification, on what side it will lie most firmly on the machine. If there be the smallest bend, the convex side must be uppermost, otherwise the tree will be in danger of turning round, to the production of much injury to itself, and of great vexation, as well as some danger, to those who have the charge of it. Care should also be taken to prevent, if possible, any of the roots or branches from sweeping the ground. Fully to accomplish this, however, will often be found impracticable.

Before the tree be taken down, the director of

the work should put a mark with chalk, or the like, on that side of the tree which faces the stormy quarter, or on which its branches are shortest, to point out how it is to be placed in its future site. The pole of the machine is now to be raised and brought in contact with the tree, an active workman being sent aloft to lash the pole as firmly as possible to the stem, taking care, by redoubled folds of mat, to secure the bark from any injury it might receive from the iron-ring at the point of the pole. A double rope of the stoutest kind must then be passed under the root, so as to seize it firmly, and balance it on the upper stage of the cross-bar, rack-pins, such as those used by waggoners, being employed to tighten the rope. Next, let the tree be brought to a horizontal position, securing its roots and branches by proper bandages from friction on the wheels or ground.

The horses being fastened to the machine, the machiner, or person among the workmen who is most expert at this part of the business, seizes the end of the pole rope that he may act as steersman, taking post three or four yards in the rear, and being provided with a stout assistant. One or two more of the workmen are stationed beneath the pole to bear up the top at first starting, while all the others apply their strength to the wheels. The

signal being then given, the machine starts, and if, after proceeding a few yards, the load does not seem to be properly balanced, it must be re-adjusted by sending up some of the workmen to the top, or other artifice.

Planting of the Trees in their new Situations.

If the pit has been trenched a year previously, as above directed, the opening of it now will be easy, and some of the workmen should be sent before for this purpose, as soon as the machine with the tree is fairly under way. Let the earth be thrown out regularly on all sides to the depth of fourteen or fifteen inches at first, leaving next the inside edge a space of eighteen inches or two feet clear. When the machine approaches, it will be easy to determine by the eye whether this be deep enough, and if not, the deficiency must be mended, making, if the tree is tap-rooted, the centre somewhat deeper than the sides, and scooping out the earth in the shape of a cup. The planter should always remember that it is advantageous to set the tree as shallow as possible, that there may be sufficient pabulum for the roots.

The machine ought to approach the pit in such a direction, as that the tree, when raised to a vertical

position, may present what was formerly its weather side to the opposite quarter. By thus altering its aspect, the part of its top most deficient in branches will be materially improved afterwards, and this, in fact, is the surest artifice that can be employed, in order to give it a regular and uniform head.

Before the tree be placed in its site, it is necessary that some means be taken to ascertain its position. For this purpose, fix a stake exactly in the centre of the pit, and let two of the workmen retire about six yards from its edge, one on the north or south, and the other on the east or west side of it. Each of them must then fix a pole in the ground, and observe what tree or other object falls in the same line with it and the stake at the centre of the pit, where the lines thus described will intersect each other. The stake in the pit is then to be withdrawn, and a piece of green turf put in its place, so that the tree may be dropped with mathematical precision on the proper place.

All these preparations being finished, as they will be very rapidly if the workmen are well trained, the machine is to be brought forward till the wheels are in contact, or nearly so, with the earth thrown out of the pit. The horses are then to be taken off, and the machine brought up right on the centre by

the united strength of the workmen. In order that this may be done properly, the director and another person must station themselves on the outside of the pit, transverse to each other, and so that the line of sight from the point where each stands may be equally at right angles to the line of the machine's direction. The workman who is placed immediately opposite to the machine directs the advance of each wheel, while the other, occupying the transverse station, orders a halt to be made at the proper moment, and in this manner the stem is brought directly to the centre, without being permitted to overshoot the mark. The wheels are then blocked to prevent their further advancement, and the roots and branches are untied. Two ropes are meantime fixed in the top transversely to each other to steady the tree when set up, and the roots of the under side are pulled toward the rear to prevent their being broken by the great weight of the descending mass. All these arrangements being completed, the steersman and his assistants, with the balanceman, if any, on a signal being given, quit their stations. and the tree suddenly rises to an upright position.

Before the ropes that brace the root to the machine, or those that tie the pole to the stem, are

loosened, care must be taken to examine, by the off-set poles, whether the tree is accurately deposited in the centre, as well as whether the longest branches have been brought to face exactly the stormy quarter. If any error has been committed in either of these particulars, the tree must be again pulled down, and the machine turned round to the proper point, which, being done, the machine is loosened from the tree and wheeled out of the pit. By proper care at first, extra labour of this kind may, in general, be avoided.

Immediately after the machine is separated from the tree, the two transverse ropes are stretched, by putting as many hands to them as may be required to balance the weight. The director must then finally determine the interesting point of depth, to save trouble as well as injury to the tree in a more advanced stage of the proceedings. If it appears to be too shallow, the error must be mended, either by bringing from some other quarter as much additional earth as may be required to cover the roots to a proper thickness, which is the better plan, or the tree is to be pulled down by means of the transverse ropes, and excavation had recourse to. On the contrary, if the depth is too great, the tree is to be pulled down in like manner, first on the one side,

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operation of his companions.

When the different parties meet, this part of the work is completed, and the next thing to be done, provided it has been found impossible to bring a large ball of earth adhering to the tree, is to let fall pulverized mould as fine and as dry as can be had, through the empty spaces of the roots from above,

and then on the other, and while in the leaning position as much earth as necessary applied below it.

A still more important point is rightly to steady and set straight the tree, so that it may satisfy the eye on the one hand, and be firmly secured against the wind on the other. For this purpose, the workmen should be divided into parties of three and three together as in taking up the tree. Of these one seizes as many as he can of the flexible lateral roots with both hands, and holds them aside so as to open a view below the tree. A second throws in mould of the finest sort he can find, in such a way as to form a bank sloping outwards against the roots so held aside, and treads it firmly with his feet; while the third, with a blunt-pointed stake or rammer, pushes in the mould, and makes it firm in the cavities. All this must be done not hurriedly or at random, but with the utmost care; the man who shovels in the earth waiting patiently for the co-operation of his companions.

When the different parties meet, this part of the work is completed, and the next thing to be done, provided it has been found impossible to bring a large ball of earth adhering to the tree, is to let fall pulverized mould as fine and as dry as can be had, through the empty spaces of the roots from above,

water being applied to settle it, until every vacuity be filled up. This management is necessary to ensure no hollows being left.

During these proceedings, the director examines the position of the tree by means of the offsets, and if he observes that it is not perfectly upright, recourse is had for adjustment to the transverse ropes, which, at this stage of the business, by putting five or six stout hands to work them, will still be able to command the tree.

"By the above method of giving stability to the tree," says Sir Henry Steuart, "*before any cover whatever is laid upon the roots*, (which, I believe, is new and peculiar to my practice), the discerning reader will see that a complete safeguard against the wind is provided, without injury to the growth of the plant. This is truly the *planting* of the tree; all else belongs to the distribution and the covering of the roots."

The next part of the operation is the distribution of the roots, which, having been first bundled up, and then merely untied during the performance of the work now completed, will, by this time, be in a state of considerable disorder. Now, therefore, they must be carefully disentangled by the workmen, and stretched out in the most regular manner from

the centre. This process is gone through by dividing the workmen into parties of three and three as formerly. One man in each divides and separates the roots, another assists in the laying and distribution, and the third throws on mould as the others require it. The "*handlers*," that is, those engaged in distributing, lay the roots in their order, higher or lower, as they proceed from the nucleus, stretching them out to their full length, to admit of which, the pit must, if necessary, be enlarged in diameter. They should be evenly spread, without crowding or confusion, giving all of them competent space in which to extend, and free scope to search for food.

To accomplish these objects, "the first thing that the principal handler has to do, is to seize with one hand a parcel of the roots, and to divide them with the other hand into as many tiers as can conveniently be laid in the depth of the pit, allowing the strata of earth between the tiers to be about an inch and a half in thickness. He then, in conjunction with his assistant, extends the larger roots of the first tier to wide distances, stretching out all the minor ramifications and rootlets intermediately in the position in which they should lie, so that no one should, if possible, touch another. The handlers

having extended these with their various inflections, to the breadth of seven or eight inches, or as far as their fingers can reach, the coverer immediately fixes them down, and secures that space with a little fine mould thrown upon it the reverse way, that is, in the direction of the points of the fibres; which mould is immediately spread and worked in by the hands of the workmen or handlers, in such a manner, as that neither the mould can displace the minutest fibres, nor exceed the thickness of a proper stratum. After which they go through the same process with the next tier, and so on with the others, till they exhaust the parcel of roots with which they began.

"It sometimes happens that masses occur not far from the collar, branching out into small and numerous stems of no great length, which it is much more troublesome to deal with. With these the only way is to divide them into tiers, and work them in the vertical instead of the horizontal position. A quantity of the finest and most friable mould must be shaken in among the shortest and least extricable fibres of these masses, so that the whole may have an opportunity of absorbing moisture from the soil."

Such is Sir Henry Steuart's method of treating

the roots, given, on account of the very great importance of this part of the process, in his own words, without abridgement. He remarks farther, "It cannot have escaped the discerning reader, that, contrary to the general practice, no decalcation or consolidating of the earth has, as yet, been directed, except in the execution of the retaining bank round the nucleus of the root; and yet the entire ordering of the roots and fibres is supposed to be finished. But I have found, by long experience, that an anxiety for immediate consolidation, which most planters possess, is not favourable to the fibrous roots of woody plants, small or great. That equability of pressure of the soil, which *gradual subsidence* alone can give, is not to be obtained by any artificial means yet known, and, least of all, by treading and pounding by the feet of workmen."

After the roots are treated as above, the rest of the earth must be filled into the pit, so that, at the stem, it may be from twelve to fourteen inches deep. If the planting takes place between November and February, a slight treading over the whole by the workmen is amply sufficient to promote gradual consolidation. If it be between the end of February and May, water should be poured on with pails from the height of five or six feet, as soon as the cover-

ing of mould is half finished. The remainder of the earth being filled in, taking care to put in the greensward first, if there be any, and regularly hand-laying it in such a way as is most effectual to retain moisture, another plentiful watering is to be given; and, after allowing the whole a day to subside, it should receive a complete decalcation or treading of the surface. This concludes the whole operation.

From the effectual securing of the nucleus of the root according to this method, no prop or support of any kind need to be applied, in order to give the tree stability against the force of wind. "I never," says Sir Henry Steuart, "prop or support a tree after removal; *yet not one has been blown down in this park in the course of thirty years:* And, as to deaths, one in from forty to forty-five, being the average number, contingency may, in some sort, be said to be excluded from an art which has in all ages been proverbially unsuccessful and fortuitous."

Treatment of the Trees subsequently to Removal.

From all large trees newly removed, it is of the utmost importance that drought be excluded. It

will be necessary, therefore, to provide some kind of cover to be laid on the surface, around the stems of the trees, in the end of April or beginning of May, when dry weather commonly sets in. The refuse of a flax-mill, called in Scotland " shows," is recommended as the best of all substances for this purpose. Before, however, this covering is applied, it is proper to go over the whole surface of the pit with a wooden beater, of such a weight as to require two men to work it. In using this implement, it should be raised to the height of three feet or more from the ground, so as to descend with the utmost force. This operation is most essential with the beech, the oak, the birch, and such others as are very sensitive of drought.

The surface must then be prepared for grass seeds, by fashioning the earth about the tree, if it swells above the surrounding surface, as it will generally do, into such form as may be most agreeable to the eye. The shows are then to be put on round the stem, and about two yards out from it, to the depth of six inches at the centre, and four at the extremities, beating them down with the spade, in order to prevent the wind from taking hold of them. The grass seeds are then to be sown over the remainder of the surface, raked in and rolled.

Round the oak and beech, the shows ought to remain without being stirred for two seasons; but with the other kinds that are less sensitive of drought, this covering may be removed at the end of the first summer after planting, or rather it should be pointed in with the spade, if the ground be not very light, as the shows will improve a clayey or loamy soil. The space which they occupied should then be kept with the hoe during the next three years.

For defending the trees from being rubbed upon by sheep, Sir Henry Steuart recommends a fence of larch-stakes, and of a peculiar construction as the cheapest, the most effective, and the least disagreeable in appearance of any that he has tried. "They" (the stakes) "are about three feet three inches long, and six or seven inches in girth at the larger end. They are also flattened at the smaller end to the thickness of about three quarters of an inch, for applying closely to the tree, and pointed at the larger, for driving them into the ground. The workmen, in setting them up, drive them into the ground, four or five inches out from the stem, and three asunder. The tops being flat, and about three inches broad, they unite in a neat manner round the stem, when pressed to it, and are firmly

bound round with marline, half twisted and pitched, such as is used on board of ship to secure the ends of the cables. A small piece of mat, four inches broad, is previously put between the tops of the stakes and the stem, to prevent chafing. As soon as the ring or hempen collar is put on, the workman who fixes it proceeds to connect it with the bracer at the centre, drawing the end of the marline half way down between the top of the stakes and the ground, and making it fast to one of them. From thence he passes it loosely round the whole, taking a turn round each stake, until he arrives at the point where he began."

"Thus it will be perceived, that a fence for trees of the firmest sort is procured, and such as will last for nine or ten years, with occasional repairs of the marline; which last, as it suffers by contraction and expansion, should, after the first year, be gone over two or three times during the summer, and kept in good order. If the larger end of the stakes be dipped in coal tar, brought to the state of half pitch, they will last from twelve to fifteen years. The entire cost of this defence, materials and workmanship, does not exceed sixpence per tree."

The first summer after planting, it is necessary

to water the trees during drought. This is accomplished by means of a watering cart, that is, a common open cart, bearing a hogshead, or other large cask, and drawn by one horse. Four or five pails, containing sixteen or eighteen quarts each, are enough of water for one tree at a time. The end of May or beginning of June is the season to begin the process, provided no refreshing showers have fallen for a fortnight. The watering should be repeated every fourth day while the drought continues.

When a tree which has stood four or five years after removal, appears to be in a backward or unthriving state, it may be restored to full vigour by the following application. "Let four cart-loads of earth be taken, of a quality rather opposite than similar to that on which it has been planted; to which, let a cart-load of coal-ashes be added, with the rough cinders carefully riddled out. Let the whole be laid round the tree, after being very intimately mixed. Then let the composition be spread on the surface, from the centre outwards, about nine inches thick at the stem, and five or six at the extremities. The best time for performing the work is early in winter, or at all events before the month of February.

"Into materials so compounded, the minutest fibres or absorbents of the root will enter with avidity, on the first approach of the genial heat of spring; or possibly the fine and friable nature of the composition may occasion an anticipation of the period. The buds ere long will expand, the leaves will be enlarged, and assume a far deeper and more lively green. By midsummer, the tree will have shot some inches; and by the following season probably more than a foot; and it will continue to exhibit both established health and progressive vigour."

Such are the principal features of the treatment which trees in open dispositions ought to receive after being transplanted. The management of such as have been formed into close plantations is similar, with the exception that it is rather more simple. In this case, it will be seldom necessary to apply the beater, and the accurate levelling of the surface is of little consequence. Watering is to be performed once every four days in dry weather, as has been directed above, but not so copiously, as, the trees being close, less evaporation will take place than in open situations. The ground in all close

plantations thus formed, should be kept clean with the hoe during the first three or four years.

The above is as full an account as the limits of this volume will admit, of the practical part of Sir Henry Steuart's system. Those who wish to have a more full explanation of it, will have recourse to his own work on the subject, where they will find the true principles laid down which should regulate General Arboriculture, and raise it from the rank of a mechanical process to that of a SCIENTIFIC ART. They will there moreover find, that the manual operations above decribed are in strict accordance with those principles, with a chemical analysis of soils and manures, and with the physiology of plants. Sir Henry's system, however, has also received the support of experience. Its utility is now fully established in the improvements effected by means of it, not only at Allanton, the seat of the inventor, but in the parks of many other gentlemen, who have lately taken advantage of it, to improve the scenery about their mansions. A Committee of the Highland Society, composed of gentlemen who will

be allowed to be most competent judges in every point connected with ornamental planting and park scenery, inspected Sir Henry Steuart's improvements in those departments in 1825; and drew up a report on the spot, in which they gave the fullest testimony to the success of his experiments. This report is inserted among the notes at the end of the work, from which the above directions have been extracted.

CHAPTER XX.

HINTS FOR GIVING QUICK EFFECT TO WOOD, IN THE PLEASURE GROUNDS OF GENTLEMEN'S SEATS AND VILLAS.

It is unnecessary to say any thing on the desirableness of having wood around villas and country residences. Every one allows, that without trees, a gentleman's seat, whether on a large or small scale, is destitute of the principal charm of rural beauty, and can never have a pleasant effect, however well in other respects the ground may be laid out, or however elegant or picturesque the architecture of the dwelling and its appendages may be. By all persons of taste, from the extensive landholder, who proposes erecting a splendid mansion on his wide domain, to the independent but less opulent citizen, who wishes to build a snug rural retreat on a few acres of ground, the raising of trees expeditiously, when they happen to be wanting, will always be

deemed a matter of first-rate importance. The readiest of all methods, by which large trees can be attained, if circumstances can admit of its application, is that of Sir HENRY STEUART; of the practical part of whose plan, a faint, though it is hoped a pretty correct, delineation has been given in the preceding chapter. Admirable, however, as the system of that gentleman unquestionably is, it will often be found impossible to adopt it, and that in the cases where wood is most wanted. A proprietor may have trees on some part of his estate; and yet the distance may be so remote from the spot which he has selected for his residence, that to convey them thither would be utterly impracticable. Another may have them more conveniently situated, and yet be unwilling to denude the spot where they now grow. A third may have them at hand, but at the same time be disinclined to incur the expense of removal. As for those who purchase a small spot for the purpose of erecting either a suburban or more retired villa, it is seldom indeed that they find their property ready furnished with full grown wood; and it will in general be impossible, even were the cost no objection, to purchase in the neighbourhood old trees fit for being transplanted. In each of these cases, therefore, it will be necessary, either

to be content without trees—to wait for their slow arrival at maturity, according to the common mode of treatment—or to have recourse to some method of accelerating their growth when planted young, different from any that has been recommended in the previous part of this work.

That trees planted at the early age at which they are commonly removed from the nursery, may be reared to such a state as will render them efficient both for ornament and shelter, much sooner than is commonly attained, will appear probable, at least, from the following considerations. In the *first* place, it is possible to make a far better selection of kinds for this purpose than is usually done. *Secondly,* Much better plants of every kind might be easily procured, than are commonly made use of, even in cases where quickness of growth is a principal object. *Thirdly,* The ground itself could be put in a more favourable state for the acceleration of growth, than we see practised in one out of a thousand instances; and, *fourthly,* The management after planting might be very materially improved. That the making choice of such plants as are naturally quick growers, using none of any description but such as are vigorous and healthy, putting the land in the most favourable state to pro-

mote their growth, and managing the plantation in a suitable manner afterwards, are circumstances which will contribute in no small degree to accelerate vegetation, no one will deny; and as little can it be doubted, that, in general at least, they are completely under the control of the planter. To attend duly to them all, will indeed be productive of more expense in laying out a plantation, than in forming it on the common plan; but the extra disbursement of money, which will be required in proceeding according to the following directions, will be found much more moderate than at first might be supposed. In a park of 100 acres, after deducting for walks, lawns, gardens, shrubberies, building stances, water, &c., the extent in wood will not perhaps in general much exceed 50 acres. Now, L. 30 an acre more than what would be necessary on the common plan, will, with judicious management, put a plantation into the most favourable circumstances. as to each of the above mentioned points, in which it can be placed. In such a case, the additional expense will amount to L. 1500, a sum which will not be considered a very great sacrifice, by a person who can afford to lay out 100 acres in pleasure grounds. In a villa on a small scale, two or three acres, or sometimes not more than half an acre, will be the

utmost space that can be allowed for trees. The expense here dwindles down to a sum that is within the means of any one, who can afford to have a country house and pleasure grounds of his own, and will scarce be grudged by any person who is anxious to enjoy the ornament and shelter of his own plantations, provided he can be convinced, that, by proceeding according to the following directions, his trees will make as much progress in ten or twelve years as they will do in thirty, according to the mode of cultivation commonly adopted.

KINDS OF TREES WHICH IT IS NECESSARY TO INTRODUCE.

In order to obtain large trees in the least possible time, it will be necessary to introduce liberally those kinds which are naturally of the quickest growth. It is not meant that they should be exclusively used, or that, on their account, any varieties that may be more valuable, more ornamental, when they have attained their full size, or which may better suit the taste of the planter, should be neglected. They can be introduced so as to serve the double purpose of affording ornament and shelter, till such time as the slower species have reached a due

size; and to perform the part of nurses to the latter, whose growth will by this means be much accelerated. The kinds most proper for contributing to these ends in ornamental planting, are the different kinds of Poplars, the yellow-barked and white-leaved Willows, the Birch, the Mountain Ash, and the Laburnum. Most of these kinds have the advantage of answering on several varieties of soil, and excepting the Black Poplar, they may all be successfully planted, whether the nature of the ground be moist or dry. The Lombardy and white-leaved Poplars, the golden or yellow willow, and the white leaved species, though they be reckoned marsh plants, will thrive, if they have sufficient depth of mould, in any situation that is not absolutely parched. In spots that are considerably elevated, and where the soil is thin, the birch and the mountain ash, together with the laburnum, will furnish the most certain and the readiest cover; and in grounds that contain more than the average degree of moisture, the black poplar and the willows should be most liberally employed, though not to the entire exclusion of the others.

The white-leaved willows, the black and Lombardy poplars, will, with the treatment after mentioned, attain the height of from 25 to 30 feet in

ten or twelve years. The birch will be from 15 to 20 feet high in that time, and the laburnum and mountain ash will have nearly attained their maximum stature. Plantations which contain trees of this size are in a condition to answer almost every purpose of ornament and shelter. At a period much earlier than this, they will exhibit a very interesting appearance, and if they be not far enough advanced to give a solemn and venerable air to the situation where they appear, they will at least, which is no small matter, redeem it completely from the character of being bare and shelterless. So early as the sixth or seventh year, the poplars and willows will average from 10 to 14 feet in height. The laburnum will be arrayed in the spring, in all the splendour of its beautiful yellow spikes of flowers, and the youthful mountain ash will be adorned in autumn with its bunches of coral berries. None of these species may possess the imposing grandeur, even when at their best, of full grown oaks, beeches, sycamores, elms or chesnuts, but the contempt with which some affect to speak of them as ornamental trees is mere fastidiousness. The silver or white poplar is a beautiful tree, whether its bark or leaves be regarded. The variety called the Lombardy poplar is remarkable for its tall, slender, and grace-

ful form. When agitated by the wind, it exhibits the most perfect freedom from restraint in its motions. As often as it feels the impulse of the breeze, the whole tree makes a free and unbroken sweep from top to bottom. The shape of its leaves is very fine; they vibrate when there is the least circulation in the air, and make an agreeable rustling when all around is breathless silence. The black poplar possesses fewer charms than either of the former. It has, however, this advantage over both, that its leaves appear much earlier in spring, at which season they have a fine yellow tint, and emit a most agreeable odour. The beauties of the weeping birch are admitted by all; and few sights in the vegetable world are more gratifying than the mountain ash, either in the vernal season when it is covered with blossoms, or in the autumnal when it is loaded with its bunches of coral berries. Both the golden and white leaved willows are magnificent trees, carrying large tops, and when they wave in the gale, the gracefulness of their movements is unrivalled. From the colour of their leaves, too, they make a fine variety among others whose verdure is of a deeper green.

It is not meant, as has been already hinted, that these quick growing species should exclude others

which are generally deemed of a nobler character; such as the Horse-chesnut, the Beech, the Elm, the Ash, and the Oak. On the contrary, the latter are to be considered ultimately as the principal part of the plantation; but the introduction of the former in considerable numbers in the first instance, is the only means by which a speedy cover can be obtained. Instead of impeding the others, they will, as has already been observed, serve the purpose of nurses, and may be gradually and slowly removed after the seventh or eighth year, till no more of them remain by the sixteenth or eighteenth, than may be subservient to variety, or suit the fancy of the proprietor. In land eminently qualified for the elm, ash, and horse-chesnut, the poplars, &c. may be introduced pretty sparingly, as these species are themselves quick growers; but when the soil is of a quality that suits better with the beech and oak, a much greater number should be used.

CHOICE OF PLANTS.

Another point of very great importance to be observed in planting, with a view to speedy effect, is to make use of no plants of any kind, but such as are in a healthy and vigorous state. A plant that

has been drawn up weak, or stunted by improper usage in the nursery, will at the first outset fall several years growth behind another, that has been put into the ground at the same time, but in a sound condition. In order to ensure the possession of this indispensable qualification, it will be necessary to be at somewhat greater expense than is usual in common planting. The plants ought not to be taken at random as they grow in the nursery lines, but the best and healthiest ones selected from these lines. Or, if any inconvenience should arise in following this plan, from the nurseryman being unwilling to pick his plants, or from his charging an extravagant price as the terms of such a bargain, the better way for the buyer will be to purchase them, as is commonly done, good and bad as they stand, and to pick them afterwards for himself making choice only of the finest plants. The principle on which the selection ought to proceed, should be to reject all but such plants as are in a perfectly sound and healthy state. The signs of health are, that the bark be perfectly fresh, unpeeled and unruffled; that none of the branches, even the smallest of them, be decayed, withered or dead at the points; that the girth be in due proportion to the height, and that the roots be numerous and well

furnished with fibres. All plants that labour under any of the defects, or want any of the requisites, now mentioned, ought to be unceremoniously rejected. If the selection proceed according to these rules, it will often happen that 150 or 200 out of every thousand will be thrown aside. This will increase the expense L. 3 or L. 4 perhaps on every 5000 or 6000; but the sacrifice will be more than compensated by the extraordinary uniformity and vigour with which the plantation will come forward.

No plants should be chosen that have stood more than four years in the nursery line. The high rent of lands often hinders nurserymen from allowing so much room to their young trees when they transplant them, as is necessary for their remaining any considerable number of years, and when they stand long, they are almost inevitably drawn up weak, or otherwise injured. Some of the kinds, such as the mountain ash and poplars, will be of sufficient size, if they have stood two years in the nursery lines; the one having been removed from the seed-bed when one year old, and the other having been originally planted as cuttings. Two years in the line are amply sufficient for the birch. As for the oak, it should not, even in ornamental planting, be taken from the nursery at all, but its acorns

should be used according to the plan described in the foregoing part of this work.

PREPARATION OF GROUND.

Another point that must be carefully attended to, is the preparation of the ground, and on this being executed properly, the quickness of the plantation's progress will most of all depend. In planting with a view chiefly to profit, it is better to let the ground remain in its original state, or nearly so, not only in order to avoid expense, but that the wood may not be deteriorated in quality, which, in many species of trees, it will be, if its growth be greatly accelerated by artificial means. Besides, where hundreds and thousands of acres of rough uncultivated moor are to be planted, ploughing, trenching, and especially manuring, are altogether impracticable; and to advise such operations, or speak of them as necessary in such cases, is in other words to dissuade from extensive planting in our waste land. When, however, it is not profit, but ornament, that is in view, the case is entirely altered, and every means of accelerating the growth of the trees, so as to make them serve their intended purpose as expedi-

tiously as possible, may be legitimately recommended. Hence, in the department of planting now under consideration, it will be proper to trench the ground, to add to the depth of soil if necessary, and to enrich it by the liberal application of manure. If the ground has been previously cultivated, as is generally the case in the immediate vicinity of a gentleman's villa or mansion, the depth of the trenching should vary according to circumstances. In soils consisting of good loam or clay, from 18 inches to 2 feet will not be too much; in poor, sandy, or gravelly soils, from 12 to 14 inches will be sufficient, or rather it would be dangerous to go to a greater depth.

In good loam or clay, the subsoil itself contains the principles which contribute to the growth of vegetables; and to stir and expose it to the air, is to render these principles active, and is equivalent in fact to increasing the quality of nourishment contained in the land. But, in pure sand or gravel, there is absolutely nothing that can contribute to the growth of a plant; to trench ground of this description to a great depth, therefore, while it creates no new fund of nourishment, is to bury the vegetable mould to such a depth, that it will be long before the roots of the trees be able to reach it, and except an

extraordinary quantity of manure is applied, they will be in a starving condition for several years. In such a case, the only advantage which can be derived from going deeper than the vegetable mould at all, is to furnish earth, which may be sufficient to cover the roots, and in which they may be able to fix themselves. In land, however, which approaches nearer to loam or clay than absolute sand or gravel, there is always considerable advantage to be gained by going to a considerable depth.

In trenching small patches, where the subsoil is so close as to be impermeable to water, or nearly so, Sir H. STEUART'S rule must be observed, namely, not to pierce the subsoil at all, as otherwise each patch will become a pool or sink in which water will be retained, to the very great injury of the roots of the trees. In every instance where the trenching cannot go deep enough to furnish a sufficiency of mould for the roots of the trees, the only remedy is to bring earth from other places where it can be spared. In the laying out of new pleasure-grounds, and in building, with which planting, for the purpose now under consideration, will in general be cotemporary, this may easily be accomplished, as there will be abundance of spare earth, which it will be necessary to remove in making walks, and in dig-

ging foundations for walls and houses. All that part of it especially, which consists of vegetable mould, should be carefully conveyed to the spot where it is intended to plant, and where there is at the same time a natural deficiency of soil. This source of improvement, when he is so happy as to possess it, should never be overlooked by the planter. By means of it, he may convert spots, originally incapable of producing trees of any kind, to fertility in any variety he pleases. Earth brought from a distance should be employed, where circumstances permit, to increase the fertility of land which is not absolutely barren. This ought to be particularly attended to in the case of single trees, which can hardly be called ornamental, unless they can be reared to a respectable size; and the only certain mode of attaining this, is to give them a more than ordinary depth and strength of soil. Single trees or small groups in a park or pleasure-ground, are most important agents in adorning and improving the landscape, and no pains should be spared in order to bring them on as quickly as possible.

Even when the land is naturally rich, its productiveness in wood may often be much increased by mixing it with soil of a different quality, brought from a distance. Strong clay ground may be much

improved by mixing it with sandy loam; and soils of a light nature with clay. Both, according to Sir Henry Steuart, may be fertilized by receiving a mixture of peat-moss. Clay or earth of a lighter nature, may, in general, be easily procured, without robbing the land, from which either is taken, of any of its productive powers. Mark off a space of sufficient size for the purpose, in any field, and lay aside the supersoil or vegetable mould. The substratum is then to be taken to as great a depth as may be necessary, or, as it remains of a good quality, and carried to the place or places where it is wanted. When a sufficient quantity of it for the purpose intended, has been procured and carted off, a foot deep more of it should be dug up and laid on the edge of the pit. The latter is then to be filled with such small stones as can be found on the surface of the field or in the neighbourhood, till only so much space be left as will contain the earth left for the purpose of conveying them. The soil taken from the bottom of the pit is then to be put on, and above it the vegetable mould, which was laid aside at first. This will restore all to its original state, and leave no breach in the ground.

In laying earth of any kind upon the ground with which it is to be mixed, it should be divided

into very small heaps, and arranged so that it may cost as little trouble as possible, to mix it with the soil as the trenching proceeds.

MANURING.

Another requisite in planting with a view to speedy effect, is to apply manure, and that in considerable quantity. It may be either well rotted farm-yard dung, free of long or fresh litter, or it may consist of ashes, street-dung, &c. If ashes or street-dung be used, at least one-third more in bulk should be given than when farm-yard manure is applied. Sixty square yards of the latter per Scotch acre should be given, even when the ground is previously in good heart, as, for instance, after a crop of turnips or potatoes. If the land be in a poorer condition, a due consideration should be made in the quantity of manure. As to the manner of applying it,—spreading on the surface, and then digging or ploughing it in, as is customary in agriculture, will not answer the purpose. It must be thoroughly mixed and incorporated with the whole soil, as deep as the trenching goes, in order that it may have its full effect. Merely spread on the surface, after the ground is trenched and dug in, it

may prove hurtful instead of beneficial. In such circumstances it will act at once instead of gradually; and if it do not induce canker, which sometimes happens when too great a stimulus is applied at once, its power will be exhausted in a year or two, during which time, though the trees may grow rapidly, they will afterwards, when the excitement subsides, be much in the condition of such as having at first been reared in a very rich ground, are afterwards removed to poor and barren soil. The roots will have superabundant nourishment for the space of six or eight inches next the surface, but all below will be comparatively poor and sterile. It is therefore of the last importance, that, whatever enrichment is given, should be mixed equally with the land from surface to subsoil. To effect this, the following method should be taken:—Let the dung be mixed, at least two months before it is used, with three times its own bulk of common earth or peat-moss; or, if it is intended to deepen the soil by additional mould, the manure may be mixed with the whole of the latter, collected in one or more large heaps. The greatest care must be taken that this mixing be thoroughly performed, in order to insure which the heaps should be turned at least three or four times

before the compost is applied. It should be laid on the ground in small heaps, before the trenching commences. When the first trench is opened, and the paring, about two or three inches thick, from the next is thrown into it,—let some of the dung or compost be spread both upon the paring in the first trench, and on the surface, from which the paring has been removed in the second. A spit depth of earth being removed from the new into the old trench, another quantity of the manure is to be applied, both on the top and along the slope of the newly turned earth, and upon the surface of what remains in the trench that is not fully opened. If the depth before the shovelling be made another spit, the same operation is to be repeated; and, last of all, after the shovelling is taken from the bottom, a portion is to be thrown on the surface, there to remain till it be dug in, when the trees are planted. Thus the work is to proceed, trench after trench, till the whole be finished. Along with the dung a very considerable quantity of lime should be given, one-third more at least than the best agriculturists usually apply to land in the same state, and of the same quality as that which the planter may have to operate upon. The lime tends to comminute the soil, and keep it in a soft state,—matters

of great importance for allowing the fibres to find their way, and it decomposes whatever organized substances of any kind are in the land, and renders them fit for nourishment to growing vegetables. Lime should, like dung, be mixed with several times its own bulk of earth, after being slaked, but should never be mixed in the same compost heap with the dung, as in such circumstances a certain chemical action takes place between them, equally destructive to the qualities peculiar to each. Whether the lime should be given in a quick or mild state, will depend on the quality of the land, and the reader is referred for information on this point to the abstract which has been given of Sir Henry Steuart's "Method of giving immediate effect to Wood." The lime should be put upon the ground in precisely the same manner as has just been directed with regard to the dung; and the same observation holds with respect to any foreign earth that may be applied for the purpose of deepening the soil.

As to the trenching of the ground, it will in general be found most economical to slump it off, at so much per acre, to such labourers as are accustomed to this kind of work. It would be highly injudicious, however, to trust them with the put-

ting on of the manure, or even of such additional earth as may be added, from another place. On the due performance of this operation, the success of the plantation in a great measure depends. It will be necessary, therefore, that as many careful hands, who understand the work, and are paid by the day, should attend the trenchers, as may be able to put on the manure, &c. according to the above directions.

PLANTING THE TREES.

THE planting of the trees may be performed at any time between November and March. In planting waste land, exact regularity as to the distances between the plants is not a matter of very great importance. When trees are planted for ornament, however, it is desirable that there should be as great uniformity as possible in this respect, and that they may be stationed in such a manner at the first outset, that no difficulties may occur when they require thinning. Due consideration should be given to the nature of the soil and kinds of trees planted, that a pretty accurate idea may be formed of the room they will require, when they have arrived at their full growth; and the trees intended

to remain after the nurses are cut down, should be placed at the intervals which may appear requisite, according to this calculation. As there will be others planted between them, it will be better that they should be planted rather too thin than the contrary,—as this mistake may be easily corrected, by allowing some of the supernumeraries planted at first to remain wherever they may be required, to fill up vacancies, arising from the others not reaching the size that had been anticipated.

If the ground, either naturally, or from being made up with additional earth, be from 15 to 20 inches deep of vegetable mould, and of a description that will answer with the oak, elm, or ash, these trees may be allowed at least 30 feet from each other. Between 12 and 15 inches deep of vegetable mould, 24 feet may be allowed between the larger species of trees; and when the depth is between 8 and 12 inches, from 15 to 18 feet will be sufficient. From 8 to 12 feet may be considered as the requisite distance in soils of an inferior quality, and where the species planted grow to a less gigantic size. The quick growing species mentioned above should be planted among the others, at such intervals, that the average distances of the whole from one another may, in the best land, be 6 or 7

feet, and in that of a middling or inferior quality 4 or 5. It will be impossible to make the intervals between these absolutely exact to an inch; but that is of less consequence, if a due uniformity be preserved with regard to the principal trees. Straight lines, excepting for particular purposes, as along the sides of avenues, &c. or even rows of any kind, ought to be carefully avoided. They have a formal and most disagreeable appearance, and give easy admittance to the wind,—an evil of the first magnitude.

In planting, the pits should be made such a size as to contain the roots when spread out at their full length. No pruning, either of roots or branches, should be practised, and fixing should be performed by treading with the foot, without, however, kneading the earth or rendering it hard. As the planting proceeds, the ground should be dug a full spit deep, leaving the surface smooth and even. The digging will be attended with several advantages. It will leave the ground in that soft state which is so favourable to the putting forth of young fibres,—it will tend to mix the manure still more thoroughly with the soil, and will render the ground much more tractable to the hoe in summer than were the operation neglected,—besides that it will give the

plantation during the winter a neat and cheerful appearance.

It will be proper, or rather by some will be thought indispensable, in planting for ornament, to pay great attention to the intermixture of the trees, with the view of preventing dull sameness of character in the plantations. Too many of the same variety should not, of course, be placed together; but it would be mere fastidiousness of taste to go upon the principle, that no two trees of one kind should be placed in juxtaposition. The planter should always bear in mind, that it is of far more importance to humour the soil than his own partiality for interspersing,—and that it will contribute in a far greater degree to beauty, to have thriving trees, with few varieties, growing on any particular spot, than many varieties, and scragged unsightly trees. To those who have not bestowed much attention on this subject, the following remarks may be the means of suggesting hints that will be useful.

In order to render the intermixture of trees with one another as pleasing as possible, the first thing that demands attention is the different shades of their foliage. The more that these can be placed in contrast with one another, the finer will be the effect. The black poplar, for instance, will have a

more striking appearance if placed by the side of an ash or a beech, whose leaves are several degrees lighter in shade, than in the neighbourhood of a horse-chesnut, whose foliage approaches its own in deepness of hue. The white-leaved willow, and the silver-poplar, will have a very fine effect, if planted near trees whose leaves are of a deep green. The shape and bearing of the tree, if the expression may be allowed, is likewise worthy of regard in planting, with a view to produce the greatest possible degree of beauty. The Lombardy poplar has a slender spiral form, and its motions in the wind are easy and graceful. The plane or sycamore, on the contrary, has a broad spreading top, and its movements are very constrained, a circumstance which makes it a fit companion for the first mentioned tree. The spray of the ash is flowing and elegant. The oak, on the contrary, looks as if it disdained to move a twig in the breeze. Two trees of these kinds, placed near one another, to say nothing of the shape and colour of the leaves, which are very dissimilar, will make a fine and powerful contrast by the difference of their motions alone. In clumps and narrow belts, it will be proper to keep the stateliest growing trees in the interior, and the humbler sorts on the outside. That the plantations may have as

lively an appearance as possible, during the winter months, the silver-fir, the yew, the holly and the spruce, should be dropped in here and there. It will be in vain to plant the first and last mentioned sorts, however, on very dry ground. The broad-leaved bay, and the Portugal laurel, may likewise be introduced on the outskirts, where they will appear to great advantage.

With regard to the management afterwards, the most indispensable of all requisites is, that the plants receive no injury from the inroads of cattle. It is no easy matter, where young trees are planted in narrow belts, small groups, or even singly, and surrounded on all hands by grass used for pasturage, as it now generally is, in parks and pleasure grounds, to prevent trespasses of the kind in question. Prevented, however, they must be entirely, or the quick growth of the plantation is utterly hopeless. Of all quadrupeds, the most injurious to trees are sheep. They, too, are most difficult to exclude; and it is by them that the grass in pleasure grounds is most commonly pastured. It is to be lamented, that no other method, equally profitable, of consuming the grass in pleasure grounds, is practicable; for these animals, useful, and even ornamental, as they undoubtedly are, never fail to be a source of

trouble and vexation to the planter. Where they are kept, nothing will save young trees from ruin, but fences too high to be overleaped by these woolly invaders. Several inconveniences arise from this. Fencing is expensive in ornamental grounds. It has a very clumsy and rude appearance; and is continually calling for repairs. All these, however, must be submitted to. Sheep, and cattle of every kind, must be entirely excluded from parks where there are young plantations; for no herding will be sufficient to preserve a multitude of scattered groups and single trees from injury. Stone fences are inadmissible; iron-railing—which, when painted an invisible green, is the least offensive to the sight of any barrier, and, to a certain extent, and in some situations, is even positively ornamental—is objectionable on account of its expensiveness. The only other alternative that can be had recourse to, is paling of wood. In order to defend the trees from sheep, it must not be less than five feet high; and the bars, in order to prevent the lambs from insinuating themselves, must not be more than nine inches asunder, if nailed to the posts in a horizontal direction; nor more than four or five, if placed in an upright position. In order to make a paling secure, strong posts should be driven into the ground a foot and a half

of their length, and not more than five or six feet asunder. They should be rendered still more secure by means of supporters, with their ends driven into the earth, and nailed to the uprights within half a foot of their tops, and sloping at an angle of about forty-five degrees. The posts, both upright and sloping, should, if possible, be of larch, as that sort of timber is by far the most durable for this purpose. The bars, which these posts are intended to support, may be either composed of *barks*, as they are termed, that is, the boards having the bark remaining on one side, which are the outside parts of a log sawn off to bring it to the square; or they may consist of long slender spars, such as the thinnings of a fir plantation from sixteen to twenty years old. A paling composed on these principles, will, with occasional repairs, last twelve or fifteen years; after which period the trees, though they will still be liable to injury from cattle, if left unprotected, will not be in such danger of utter destruction as at an earlier stage of their progress. With materials of the same kind as those now mentioned, many varieties of ornamental rustic work, in paling, may be executed, and which may be employed in such situations as are much exposed to view. Not only must sheep and cattle of every kind be ex-

cluded from the young plantations, but even human intruders of every description, with the exception of those who are under the necessity of entering for the purposes of pruning or of cleaning. Half a dozen of schoolboys will do more mischief during a holiday, than an equal number of Highland wedders. Nurses with children are scarcely less dangerous while the trees have branches that can be pulled off within five feet of the ground. These observations may appear minute; but I have known very promising plantations nearly ruined by transgressors of the two last denominations. Every twig that is torn off, every rough handling that the bark receives, and every unnecessary foot that hardens the ground, has a tendency to injure and impede vegetation.

That the plantations should be kept perfectly free from weeds during the first five or six years, is absolutely necessary, if it is wished that the growth of the trees be accelerated to the utmost. Five or six hoeings will be requisite every summer. The destruction of weeds is only one of the benefits that will accrue from this labour. A still more important one will arise from the frequent stirring of the earth, than which nothing has a greater tendency to invigorate plants of any description. It has been

said, that a plantation in which the earth is frequently stirred, and the weeds destroyed, will make as much progress in seven years, as another placed in equally favourable circumstances, with the exception that this work is neglected, will do in seventeen. This may be going beyond the truth; but nothing is more certain than that the operation now recommended will prove in the highest degree beneficial.

Dry weather should be chosen for the hoeing, as it is then that the weeds can be killed most readily, and that the stirring of the earth is most beneficial to the trees. The common hoe should be used, and none but expert and careful workmen should be employed. The trees must not be touched; for, if their bark be ruffled or peeled off, it were better that the weeds were left without molestation.

Pruning must be performed in the same sparing and gradual manner as has already been directed. With regard, however, to such of the poplars, &c. as are merely intended to make a show till the slow growers are of a stature to render them no longer necessary, the knife may be used more freely whenever their branches interfere with the latter. So long indeed as severe pruning of the supernumeraries can be made to answer the purpose of admitting

a sufficient quantity of air and light into the plantation, they ought not to be cut down; but, so soon as this method becomes impracticable, the thinning process must be immediately commenced, and go on gradually from year to year, till the trees at last stand at the distances which they will finally require.

Thus a hasty sketch has been given of a method, that, if properly executed, will be the means of raising trees for ornament much more expeditiously than is usually attained. Few persons, perhaps none, may have had the opportunity of seeing the efficacy of this mode of treatment put to the proof designedly, and on a tolerably large scale; but many have observed how much more rapidly a plant grows up into a tree, if allowed to do so in the nursery, than in ground in that condition in which it is usually set apart for wood, with a view either to ornament or profit. Many must have likewise observed, that some varieties grow much more quickly than others, and that a healthy plant, of any kind, makes far quicker progress than a sickly one of the same description. Now, the method which has just been sketched out, is simply this,—to make the land, by artificial means, as like that of the nursery as

possible; to take advantage of as many of the quick growing species as can with propriety be introduced, and to make use only of plants that are in a sound and healthy state. These principles are of a perfectly obvious kind; and it is somewhat extraordinary that they should have been so seldom had recourse to, considering the great anxiety that is often felt for the quick progress of ornamental plantations. Perhaps the circumstance can only be accounted for, by referring it to that species of prejudice that arises from long-continued habit. From time immemorial, people have been accustomed to see trees put into the ground, and left to the care of nature; and hence planters have, in general, from age to age, considered it as a self-evident maxim, that no artificial means can be rendered effectual in stimulating their progress.

It is sometimes imagined that wood kept below water must be very subject to decay, and must soon be destroyed by rottenness; an opinion which appears to have arisen from the well known fact, of moisture being productive of decay in vegetable substances exposed to the weather. It is only when wood is exposed to the action of the atmosphere, however, that water or dampness produces rottenness. If kept always completely below water, timber of almost any kind will last longer than when kept entirely free from moisture. Rottenness, or natural decay, is most speedily produced in all vegetable substances, by alternations of moisture and drought, or being kept between wind and water. Some species of wood resist the evil consequences of such changes better than others; but, in general, an exposure to them is the most trying situation in which timber can be placed*. Paint, pitch, turpentine, and resinous substances in general, are well known preventives of rottenness, and are commonly employed, frequently with much success, for that purpose, when wood is used in circumstances peculiarly exposed.

* I do not here speak of dry-rot, which is not attributable to natural decay, but to particular diseases, or rather to the attacks of fungous vegetables, and of insects.

moisture to evaporate before applying the wood to use. If unseasoned wood be cut into deals, and formed into any piece of workmanship, for instance a door, the shrinking produces open chinks in the joints, and not unfrequently splits the deal. This is particularly the case with fir-wood of every kind, but especially the larch.

Another circumstance is worthy of remark, in regard to the application of wood in general to useful purposes. The outer parts of the tree, nearest the bark, commonly termed the Sap-wood, is weaker, and much more liable to rot, than the interior part, or heart-wood of the tree. Sap-wood is of less importance in old trees than in young ones, and in hard wood than in firs; but, in general, where wood is used for purposes requiring great durability, it should be planed off, as the greater part of it usually is in squaring the logs. In general it may be easily known, both by a difference in colour (being whiter), and a difference in texture, from the heart-wood. In examining old floors, it will frequently be seen, that the edges of the deals are destroyed by the dry-rot, while the centre is quite sound; a practical exemplification of the fact here mentioned, the edge being easily seen, in such cases, to be part of the sap-wood.

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I now proceed to notice the various properties of different kinds of wood, and the uses to which the respective kinds are applicable.

OAK.

OAK is among the different kinds of timber what iron is among the metals,—the most durable, the most general in its application, and the most universally diffused over the surface of the globe, if the various species be taken into account. Some timber is harder, some is rent with greater difficulty, and some will bear a greater strain without breaking crosswise; but none possesses all these qualities in an equal degree with the oak. In former ages this tree was used throughout Great Britain in every department of carpentry, and our ancestors had not only ships of oak, but oaken roofs, oaken floors, oaken doors, and oaken furniture of every description. It is still employed for several purposes in machinery, and beams of it are occasionally introduced into roofs and other erections, where great strength is required; but the principal use to which it is now applied, especially when of home growth, is ship-building,—a department in which its place can be but indifferently supplied by any other kind

of wood. Our dockyards would furnish a ready market for native oak, though our woods were stocked with it a hundredfold more plentifully than they are. The planter need therefore be under no apprehension that the supply of this tree will ever exceed the demand, so long as we are a naval power and a commercial country. British oak is said to last three times as long as the species brought from America, and twice as long as that imported from most parts of the continent of Europe; so that our own produce will always be preferred to any other, when offered for sale in our own markets; and, should we ever have it in such quantities as to be able to export it, its superior quality will obtain for it a ready market abroad.

The bark of the oak is the most valuable of any for tanning, and is largely imported into Britain for that purpose. Coppice-oak, in Scotland, is chiefly raised for the sake of the bark, which is more valuable in young trees than in old ones.

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Fir is most generally known in this country, and, in many respects, does not yield in usefulness to that of any of the tribe. With the single exception of the larch, which exceeds it in hardness and toughness, the Scots fir, as timber, is decidedly superior to any other of the pine-tribe cultivated in Britain. All Scots fir timber contains a portion of rosin, and that which contains the most is in least danger from insects, and therefore the most durable. The older that the tree is before being cut down, provided it has not been allowed to decay while standing, the better is the timber, and the less sap-wood it contains. The best part of the tree is that next the root. The Scots fir is employed for every purpose in architecture, and answers equally well, whether used as roofing, flooring, doors, or window-sashes. It is also not unfrequently made into chairs, tables, and other articles of coarse household furniture. It is deemed the most proper of all timber for forming the breasts of violins, and it is used for sounding-boards in the construction of organs and other musical instruments. In ship-building it is used for masts, and in the partitioning and other inside work of the ship.

The Larch has not yet been so generally used by carpenters in this country as the Scots fir. Its

timber, however, is of a very superior order; and, when its qualities become more generally known, it will probably supplant the Scots fir, in many of the purposes for which the latter is at present exclusively employed. It may perhaps be inferior to the wood of the last-mentioned tree, in being heavier in proportion to its bulk, more liable to warp, and less pliable to work; but it more than counterbalances these defects by the superior closeness of its grain, its greater beauty when dressed, its power of supporting pressure without breaking; and, above all, its impenetrability to insects, and uncommon power of resisting the effects both of fire and water. Were it used in building, destructive conflagrations would be far less frequent than they usually are,—as a beam of larch will scarcely be charred, when one of Scots fir, of spruce, or even of oak, will be nearly consumed *. In Italy, where

* I once saw a remarkable instance of the incombustible nature of larch, in the case of an accidental fire in Aberdeen. A house which had been built with home wood, principally Scots fir, was burnt to the ground, but a few joists were observed to remain standing amid the ruins. On examination it was found that these joists were of larch, and that they had so completely resisted the action of the surrounding fire, by which the other species of wood had been entirely consumed, that they remained

larch has been used for ages in the construction of houses, there are many very ancient buildings, in which the larch beams and flooring do not exhibit the trace of a worm, or decay of any kind. At Venice, where piles of this wood have been much used, the most unequivocal proofs are said to exist of its indestructibility in water. It has the advantage, too, that it may be cut down for use at a much earlier period than the Scots fir. When used at forty years old, in the construction of boats, it has been known to last as long again as the best Norway pine employed for the same purpose. Larch wood may not only be formed into the plain furniture which is used in kitchens, cottages, &c.; but, with the aid of a little varnish, will do very well for bookcases, writing-desks, shop-counters, and many other purposes where appearance is of considerable importance. Its property of resisting moisture makes it answer well in all out-door work, especially for stakes and posts, which require to be driven partly into the ground. Its durability, in this capacity, has often been put to the test, and

so slightly injured, as to be fit to be used for the same purposes they had formerly served, when the house was rebuilt shortly after; and they were accordingly used in that manner.

found of a very superior kind. The thinnings of larch, sixteen years old and upwards, may be used with excellent effect as paling, without being at the trouble of taking off the bark.

Larch has been used with much success in making carts, harrows, wheelbarrows, and other implements of agriculture, for which it is eminently qualified by its lightness, strength, and durability; and it would be more used for these purposes were there not a prejudice against it among country carpenters, owing principally, as they say, to its being difficult to work. It certainly requires the tools to have a finer edge, but that is but a slight price to pay for its superior qualities. A cart can be constructed of larch at about two-thirds of the expense which it would cost if built of ash, and it will be as strong and durable, and little more than half the weight of the latter. These are important savings, and agriculturists will find it their interest to turn their attention to the subject.

Nor is it for country purposes alone that the consumption of larch may be advantageously increased. It is of the very first importance as a substitute for oak in ship-building, as it possesses all the qualities most prized in the dockyard—toughness, strength, elasticity, lightness, and closeness. At the same time,

vessels may be built of larch at little more than one-fourth of the cost of building them in oak, and even at much less expense than if built of Memel or Norwegian fir; and I have no hesitation in asserting, that, if not so lasting as the former, it will endure much more fatigue than either of the latter. Larch wood seems to have the peculiar quality of acquiring hardness by being exposed to wind and water, which, as already said, is the most trying situation in which wood can be placed, and which is so fatal to other timber of the fir species, and even affects, by degrees, the British oak. I have seen some larch-planks taken from the bottom of an old lighter, which had been built twenty-five years before, chiefly of the best Memel fir. With the exception of the larch-planks, the whole fabric was rotten almost to powder. During the twenty-five years the vessel lasted, these planks had been exposed alternately to wet and drought, both in salt and fresh water, and they did not shew even the most distant symptoms of decay. On the contrary, they were so hard as to resist the edge of the best-tempered carpenter's axe, and even the saw made but a slight impression upon them when applied crosswise. When tried to be split with wedges, they shewed no aptness to splinter, a quality of great importance in ship-build-

ing, and one which the larch possesses in an eminent degree. As an example of this, I may mention, that if a target be made of larch-timber, properly seasoned, and of the thickness of ship-plank, and fired at with shot of any description, it will be found that the balls form a clean hole, as if pierced with the auger of the carpenter, and without a vestige of splinter, the wood being carried off exactly to the size of the ball. I can make but slight pretensions to judge of what may be advantageous and conducive to the strength of the Royal Navy, but I am inclined to think that this last quality, joined to the other known properties of larch-timber, would point it out as at least worthy of trial *.

Whatever may be its capabilities, and the chance of its introduction into the Royal Navy, larch is well ascertained to be of great value in building merchant vessels. I have seen several built en-

* I recollect of having read a letter from a naval officer to the Admiralty Board, describing a naval engagement (and my impression is that it was the letter of Lord NELSON, communicating the victory of the Nile), in which it is stated, that more of the men were killed by splinters from the different places of the ship, hit by the enemy's shot, than fell by their balls. If larch, possessing the quality I have mentioned, be found to answer for building ships of war, this circumstance alone will shew the importance of introducing it.

tirely from it (with the exception of the keel pieces, of course), and two were very recently built from it in the woods under my charge. They are generally built in the woods where the timber is found, a practice which ought to be followed in every instance where it is at all possible, as, besides the saving of carriage, the carpenter can select his wood on the spot, measure its length while the tree is standing, and is by this means never incumbered with useless wood. At the same time, the forest is almost always the better for them, as they use great numbers of crooked and unsightly trees for futtocks, floors, &c. that would otherwise bring no more than the price of fire-wood, being entirely useless, except for the purposes to which the shipbuilders apply them. Thus the wood is cleared of its rubbish, and at the same time a profit realized to the proprietors.

The two vessels which I have alluded to as being built of larch in the woods under my charge were, when completed, taken to pieces and driven to the sea-port of Montrose, a distance of twelve miles. I was told that they were built at one-third less expense than if they had been constructed of Memel or Norway fir, although the usual price was paid for the larch used in their construction.

Among the qualities which render larch so suitable for ship-building, I should not omit its pliability, or easy adaptation to any desired set, especially when cut into planks. Oak, and indeed almost every other kind of timber used in ship-building, requires to be bent by the process of steaming, an operation generally unnecessary with larch. This of itself is a great advantage. In building vessels of larch, great care should be taken to exclude the sap-wood, a thing which will be neither difficult nor expensive, as larch trees which have attained a size fit for ship-building, particularly if on favourable soil, and of the age of thirty-five or forty years, will have very little sap-wood to be removed, after the logs are squared, as that process should take off the whole, or nearly the whole of it. The sap-wood of the larch is peculiarly liable to the attacks of the dry-rot, and the injury thence arising has gone far to create an unjust prejudice against this sort of timber altogether.

Larch is very apt to shrink and warp, if wrought before being properly seasoned, although the seasoning is of less importance in ship-building, where the wood is used in thick logs or planks, than when used for other purposes in thinner deals. Still it is proper to be observed, wherever it can be convenient-

ly done. The best method of seasoning is to kill the vegetation of the tree the season before it is cut down. This may be done either by peeling off the whole bark, as recommended by MONTEATH *, or by merely peeling it off all round the tree, to the extent of six inches perpendicular, close to the root. If treated in this manner early in spring, the tree may be cut next winter.

Besides the value and importance of larch-timber in the other parts of ship-building, the roots form excellent knees, and great numbers of them are now used for this purpose †. To understand this, it is necessary to explain, that the roots of the tree branch off horizontally under ground in three, four, or five leading stems, nearly at right angles with the upright trunk of the tree. These roots always attain a large size in trees of some age, and they are of great strength and toughness. To know whether the roots are of size sufficient for knees, the surface-earth must be removed to the extent of about two feet around the tree, with a mattock.

* Forester's Guide, p. 248.

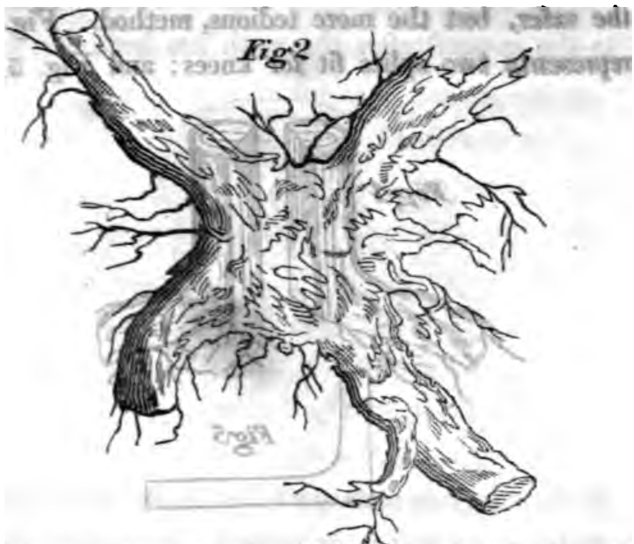
† A knee is a piece of wood used for joining the beams to the ship's side, and is in shape two sides of a triangle. The one side is screwed to the ship's side, the other to the beam, which is placed between two knees, both of which, with the beam, are transfixed by screw-bolts.

Fig. 1. represents the root of a larch standing in the ground after the earth has been dug away.

Fig 1

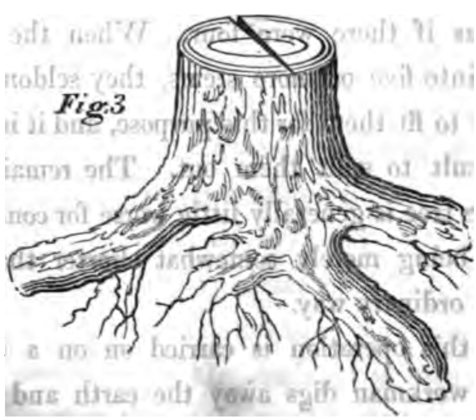
If there be four roots spreading horizontally, of a diameter of six inches or more at the distance of two feet from the trunk of the tree, it will suit for knees. The earth is then a little farther removed with a spade, so as to lay the roots bare, and the roots are cut at the distance of two feet or more from the trunk. The tree is then easily pulled over by the help of a rope, which should be fixed near its top, before the earth is dug away.

Fig. 2. (on the next page), represents the root after the tree has been thrown over. The root is then cleared of the earth, and the trunk of the tree is cut two feet or more from the angle formed by the root, as may be required. If there be four leading roots, the trunk of the tree is split perpendicularly into four parts, taking care to have a root attached to each part, and carefully observing also to split



the trunk, so as to give each portion all the strength possible.

Fig. 3. shews the root, with marks for split-



ting out the knees. This operation may be done with wedges, or a saw, the latter instrument being

the safer, but the more tedious, method. Fig. 4. represents two splits fit for knees; and Fig. 5. a

Fig 4

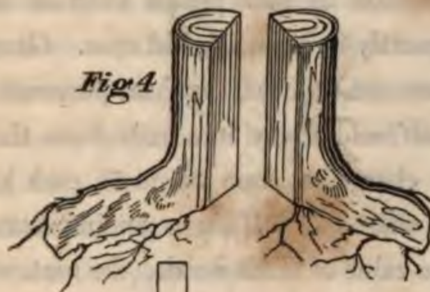
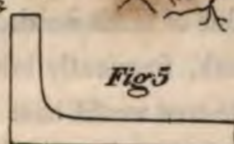


Fig 5



dressed ship-knee. If there be only two or three horizontal roots of sufficient size, the trunk must be split accordingly; but, in such a case, the profit is of course less, nearly the same labour being required as if there were four. When the root branches into five or more stems, they seldom attain a size to fit them for this purpose, and it is also more difficult to split them out. The remaining part of the tree is generally little worse for common purposes, being merely somewhat shorter than if cut in the ordinary way.

When this operation is carried on on a large scale, the workman digs away the earth and cuts the roots, leaving the tree to fall by the next wind,

which it generally does, this being accounted a saving of labour. The knees thus produced are sometimes used in new vessels built of oak, but more frequently in repairing old ones. Great numbers of them are required for these purposes; and I have myself sold many hundreds from the woods under my charge, at from 3s. to 7s. each knee, according to their size. This is an important addition to the value of larch woods, the root, with two feet of the trunk, frequently bringing more money than the whole tree would have done, if cut in the ordinary way, for planks or other purposes. The expense of making larch roots into ship-knees is comparatively trifling. Four workmen, accustomed to the work, will, with the chance of wind, throw over from twelve to fifteen trees, and split out the knees from them, each day, on an average.

The next of the fir species in importance is the Spruce. As timber, however, it is much inferior both to the Scotch fir and the larch, though it is much more common than the latter. Its timber is whiter and softer than that of the Scots fir, and, what is still worse, far less durable. It has, however, this advantage, that it is very easily wrought, and tries the carpenter's tools less than any other

kind of wood used in building. This, together with its cheapness, causes it to be pretty frequently used in inside work, as doors, flooring, stairs, &c. One purpose, however, there is, for which it is unrivalled, viz. rustic work in gardens and pleasure-grounds, such as seats, pillars for arbours and ornamental cottages, &c. In these capacities it is commonly used with its bark on and its knobs entire, and makes a very romantic appearance.

The timber of the Silver-fir is said, like the spruce, to be inferior to that of the Scots fir. It has, however, two properties, which, for some purposes, are of no small value, viz. great lightness, and little or no tendency to shrink or warp.

ASH.

Next to the oak, the most important of all hard-wooded trees, on account of its timber, is the Ash. It possesses great elasticity, and will bear a considerable strain crosswise. Its chief defect is, that it is very easily split in the longitudinal direction. Unlike most other trees, the quicker it grows, and the sooner it is cut down, after it attains a useful

size, the better is its timber. Its quality is much deteriorated when it grows in poor and exposed situations; in which case it loses much of its elasticity, and becomes short and brittle. The ash has very appositely received the name of the Husbandman's Tree, and its timber is the best qualified of any for ploughs, harrows, cart-axles, and agricultural implements of every description. In coach-making, it is used for shafts to carriages; and its elasticity adapts it particularly for all long handles, poles, oars, ladders, &c. In the state of suckers and young shoots it makes excellent hoops for small casks. Good ash is always in demand.

ELM.

THE Elm is remarkably strong and tough in its texture, and is well adapted for most purposes in which these properties are pre-eminently required. It is often used as a substitute for ash in making agricultural implements, in which capacity it is found to answer very well. It makes very strong furniture, such as tables, chairs, presses, bedsteads, &c.; and may sometimes be found of so fine a grain, that, with the aid of varnishes, it looks wonderfully

well. It is deemed improper for building, but is much used in machinery and coach-making; and, as it lasts well under water, and resists friction, it is in request for keels of ships. It makes the best naves for wheels of any wood grown in Scotland, and is generally in great demand for that purpose. The cohesion of the grain is sufficiently strong to permit, without splitting, the spokes of the wheel being hard driven into it,—a very trying operation, when it is considered that the naves are in general only a foot in diameter, and must be also bored in the centre. Neither is it apt to split from exposure to the sun, as ash is. Elm, grown in Scotland, is said to be of a much better quality than when grown in the more fertile parts of England. But this must not be understood of the different species cultivated in the two countries, as what is generally called the English or small-leaved elm (*U. campestris*), is accounted better wood than the Scotch or large-leaved elm (*U. montana.*)

BEECH.

Beech is close-grained and altogether of a remarkably close texture. When exposed to alternate dryness and moisture, it soon decays; but, when

kept entirely under water, or when used for purposes in which it is continually dry, it lasts well. It does not bear a great strain crosswise. Like elm, it is much used for ship-keels, as well as in turning; and is in great request in machinery. It is well adapted for piles under water, and all similar purposes.

SPANISH CHESNUT.

The Spanish Chesnut should have been placed next the oak, which it strongly resembles in its properties, and, in fact, would of all trees come nearest it in importance, were it not that it is very sparingly cultivated in this country. Of its durability the most undoubted proofs can be given, as many of the oldest mansions in England have been built of it. The roof of Westminster Abbey, which is now upwards of 700 years old, is composed of Spanish chesnut, and betrays no vestige of decay. Possessing all the strength, durability, and toughness of the oak, the chesnut has this advantage over it, that it is of a finer colour.

PLANE, OR SYCAMORE.

THE wood of the Plane is, like the beech, close-grained, but much more beautiful. The backs of violins are generally made of plane-tree; and, when of good workmanship, they furnish as good an example as can be given of what plane-tree can be made by the aid of varnish. This wood contains few or no knots, or any thing to injure the edge of tools. It is, therefore, very easily wrought, and well adapted for cutting-boards, in which capacity it is accordingly very frequently employed. It warps or shrinks very little, and is, on that account, extremely eligible for saddle-trees, founders' patterns, &c. Not being subject to crack, it is much superior to the beech for turning into wooden dishes. Cabinet-makers find it well adapted for various uses in the formation of household-furniture. Millwrights also make use of it for various purposes in constructing machinery.

LIME-TREE.

THE Lime, though not a strong timber, is yet remarkably close in the grain. Its colour is a pure

white, without any variation of shade. It is less subject to decay than either beech or plane, and less liable to be injured by worms. It cuts clean and easily with the graving-tool, and carvers accordingly employ it more than any other wood.

BIRCH, if it be not so durable as some other kinds, has the advantage of being remarkably cheap, as it will grow on soil where scarce any other tree will prosper. Its colour is white, and it is much prized by turners for its lightness, closeness of grain, and being easily worked. It is the material out of which shoemakers form the wooden pins which they drive into the soles of shoes. For rough gates and paling no material is better; and, in the Highlands, it is used for every purpose in which wood is required—as rafters and doors for houses, agricultural implements, household-furniture, and dishes. It is found to answer extremely well for herring-barrels, and much of it is now used for this purpose.

ALDER—POPLAR—WILLOW.

The wood of the Alder is of a reddish-colour; it is extremely soft and pliable to work. In some parts of Scotland all sorts of wooden dishes are turned from it. Much of it is used for herring-casks. It bears moisture well, and may therefore be advantageously used as piles for foundations, wooden pipes, &c.

The wood of the Black Poplar is reckoned rather more durable than that of the other varieties, none of which resist either the rot or insects for any considerable period. They are, however, extremely light, and tolerably free from any tendency to shrink or warp. It is exceedingly well qualified for packing-boxes, and all purposes in which lightness and cheapness are of more consequence than durability.

The timber of the Willow, though soft, like that of the poplar, is at the same time very tough, in proportion to its gravity. It lasts long under water, and is well qualified for pipes. Charcoal made of it is said to be superior to every other kind for the manufacture of gunpowder.

HORSE-CHESNUT—MOUNTAIN-ASH—HAWTHORN—HAZEL.

The Horse-chesnut is so soft and spongy that it is scarce good for any thing. Notwithstanding its beauty, as a tree, its timber is perhaps the most worthless of any that grows on the island.

The wood of the Mountain-ash is only used for rough purposes. The shoots or suckers that start up from its roots are often used as hoops.

The Hawthorn, when it attains the size of a tree, produces a very hard, tough, and durable timber. It may be used for a variety of purposes in machinery and in turning. It is manufactured into clubs for golf-playing.

The Hazel is in great demand for hoops, makes excellent walking-sticks, and the charcoal manufactured from it is highly prized.

LABURNUM—HOLLY.

The Laburnum furnishes timber of various application, and considerable value. It is extremely hard—the colour of its wood naturally good—and, by soaking it in lime-water, it may be made like the

darkest mahogany, or even as black as ebony. It makes strong and beautiful chairs, and, when it can be procured of the requisite size, equally good tables. Laburnum is employed to some extent in machinery, especially in block-making, and is often wrought into ornamental work by turners. It makes good pegs, and answers well for handles to various instruments.

The Holly, a plant which is too much neglected, furnishes the hardest and most compact timber we have. It requires to be well dried before it is used, otherwise it is liable to warp. Its natural colour is white, but it may be stained to any required hue, as it takes and retains any dye readily and well. It may thus be made to imitate ebony, or any of the harder ornamental woods, which are commonly imported from abroad. Cabinet-makers use it much in ornamental work; and it is often in request by turners and engravers.

The following brief summary will place the substance of what has been said more completely under the view of the reader, the various species of timber being placed in connection with the respective departments in which each is most commonly used.

HOUSE-CARPENTRY.—Scots Fir, Larch, Spruce, Silver-Fir.

SHIP-BUILDING.—Oak, Elm, Beech, and different kinds of Fir.

COACH-MAKING AND AGRICULTURAL IMPLEMENTS.—Ash, Elm, Oak, Beech.

MACHINERY.—Oak, Elm, Ash, Beech, Plane-tree, Laburnum, Hawthorn, Holly.

CABINETMAKING.—Elm, Beech, Plane-tree, Chestnut, Holly, Lime-tree.

TURNING.—Beech, Plane-tree, Hawthorn, Holly, Birch, Alder, &c.

CARVING.—Plane-tree, Lime-tree, Holly.

COOPER-WORK.—Oak, Plane-tree, Willow, Hazel, Birch, Alder.

APPENDIX.

APPENDIX.

No. I.

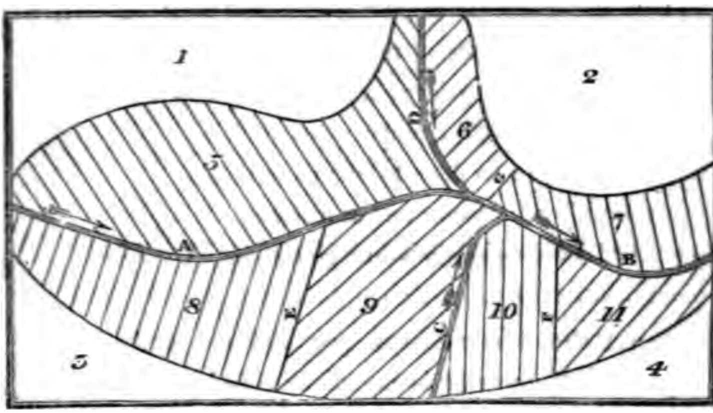
ADDITIONAL REMARKS ON DRAINING.

SINCE the observations at page 123, &c. on the draining of land, or what is commonly called water-tabling, preparatory to planting, were written, it has been thought necessary to add something farther on that subject, as it is of very great importance that the ground on which trees are planted be properly dried, and kept free of surface-water. The following diagrams have been prepared to shew the method of performing the operation to the best advantage, and at the least expense.

When waste ground is to be planted up, it ought to be ascertained whether the wetness of the lands arise from a want of declivity, and a retentive subsoil, causing it to stagnate on the surface, or from springs in the lands, as different modes of draining must be adopted in each of these cases.

Fig. I. Represents a piece of ground wet by surface water, owing to the retentive subsoil and want of declivity, to remedy which the following operations will be necessary.

Fig. I.



Cut a drain, as AB, along the lowest level of the field, of such dimensions as to contain the quantity of water, which may be easily judged of by the extent and nature of the grounds. This is called the leading or main drain; and where the ground is unequal, forming hollows, it will be necessary to have side drains leading into the main drain: these will require to be half the size of the main drain or leader, and are represented by C and D. When the ground rises into brows or eminences, such as at EFG, the tabling or small conductors must be carried in the direction of the declivity, either into the leader or side drains. Nos. 1, 2, 3, 4 represent dry porous ground,

where the water easily escapes. Nos. 5, 6, 7, 8, 9, 10, 11, wet ground with a retentive subsoil, preventing the water from escaping, whereby it accumulates on the surface.

The operation of surface draining is generally performed with the spade, the usual dimensions of the drains being about 18 inches wide at the top, 9 inches at the bottom, and about 14 inches deep; when these drains are numerous, the work is tedious and expensive. In many cases this operation might be done by the plough, at much less expense than by the spade, and at a season of the year when no other field operations are going on. A very strong plough must be used, drawn by four horses, to draw a furrow down hill: where the declivity is not too great, the plough should return close by the back of the furrow thrown up, thus cutting the solid ground out; or it might return in the same track, throwing a furrow over the other side: but when the declivity is very great, it will be preferable to draw all the furrows down hill, the plough being brought up empty; the expense is nearly the same by either method, and the particular circumstances of the case will best determine which of them should be used. Where the declivity is considerable, this method will answer tolerably well; but if the ground be level small drains soon fill up.

When a large extent of ground is to be planted up, and when the declivity is small, it will be necessary to cut all the drains with the spade: these should, on wet

soils, be 3 feet wide at top, 1½ foot at bottom, and 2½ feet deep, and from 18 to 24 feet apart: these from their size, though there be but little water running in them, will remain a long time open.

Fig. II. Represents the method of draining lands, where the wetness arises from springs. The dotted lines shew the line of springs.

Fig. II.

Dry porous high bank.

Dry porous high bank.

Cut a main drain along the lowest line of level, as AB, of sufficient dimensions, and from the springs Nos. 1, 2, 3, 4, rising at the bottom of the bank, and seen on the plan, cut conductors leading into the main drain, of sufficient depth to contain the water issuing from the springs; but should the ground be very unequal, and the springs numerous, it may perhaps be necessary to make a main

ALDER—POPLAR—WILLOW.

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surface of clay or other impervious matter; the lower springs at C always running, those at B generally, and those at A when the ground is very wet. D is the main drain or outlet falling into a rivulet R, as seen in the plan.

After having examined all excavations near the place to be drained, such as quarries, ditches, beds and sides of rivers, and sunk wells, and thereby ascertained the nature of the different strata below the soil, the surface of the ground in question, and the nature of the plants, will shew where springs arise; and from other observations, or from measurement, it may be ascertained what is the angle of descent which the open porous soil makes with the clay soil.

From these observations, when circumstances permit, a great saving may be made, by making a ditch of sufficient size in the line CCC, and boring with an auger, as pointed out on that line, into the tail of the gravelly subsoil. The water finding easier vent through the auger holes at the lower elevation, will flow through them alone, leaving the springs at AA, BB and CCC completely dry.

It is the pressure of the water above the level of the main drain that causes the water to spring. Any person who may have paid attention to digging wells, must have observed, that after cutting through an impervious soil, and entering into gravel, sand, or chinky rock, the water, if any, naturally rises to some certain height, correspond-

ing to some other outlet, although perhaps not visible. The mode of draining now recommended is founded on this principle, that an outlet in an inferior elevation takes off the pressure which causes the springs in the higher elevation. In boring, it will sometimes be necessary to pierce quite through the first open stratum, and again through another bed of clay, until the porous bottom containing the water is reached.

It is sometimes necessary to carry a drain across a mill-lead or some other aqueduct, the level of which is higher than the ground to be drained. This is done by means of a square box, of the size required to hold the water which the drain emits, placed in a groove carried across or below the lead, towards the river or stream flowing in a lower level. On the bank of the river it will be necessary to make a back ditch, and form an embankment between it and the river, to keep off all flood-water. Another back ditch may be made if necessary along the side of the lead.

When land is water-locked, owing to an impervious soil or subsoil, and on examination it is found impossible, or too expensive, to procure a fall, the water will sometimes be got rid of by boring through the impervious soils into the open strata below. The water can be previously collected in drains, made in the manner represented in Figure I.

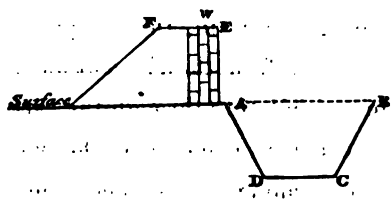
The earth taken from the main drains, conductors and tabling, may be used in filling up any small hollows or

inequalities of the surface, or spread over the ground between the drains, as circumstances may dictate.

In planting waste lands, the first operation should be the boundary fences, and these, where the lands are wet, may be formed of turf or sods. This serves a twofold purpose, viz. acting both as a drain, the cut preventing all the surface water flowing from the adjacent lands, as well as the under water, circulating through the earth to the depth to which the cut is made, and the earth raised from the excavation forming a face-fence against the intrusion of cattle, &c. Those who have paid attention to this subject, must have often observed considerable portions of ground laid dry by means of a sunk fence; indeed all grounds liable to wet should be enclosed with dike and ditch for the boundary fences: the general dimensions of these are, the ditch 5 feet wide at top, 2¼ feet wide at the bottom, and 2½ or 3 feet deep, built with a scarsement of 1 foot, to secure the built dike from being endangered by the action of the frost upon the face of the ditch; but when the grounds are dry, and materials easily procured, a stone-dike is beyond doubt the best defence. When the enclosures are face-fences, it is common to sow whins on the top, which in a few years make an excellent fence.

A dike and ditch of this description are represented in Figure IV.

Fig. IV.



A B, Ditch 6 feet wide at surface.

B C, do. 2½ feet deep.

C D, do. 2½ feet wide at bottom.

A E, Dike 2½ feet high, built of feal or sods, raised from the surface A B.

E F, do. 2 feet wide at top.

W, Whin bed on the top of the dike.

TABLE

Shewing the Solid Contents of 1 running yard of Drain, from 1 foot to 4½ feet deep, and from 1 to 10 feet broad.

1 Yard Length.		Depth 1 Foot.			Depth 1 Ft. 6 In.			Depth 2 Feet.			Depth 2 Ft. 6 In.			Depth 3 Feet.			Depth 3 Ft. 6 In.			Depth 4 Feet.			Depth 4 Ft. 6 In.		
Breadth.		Y.	F.	I.	Y.	F.	I.	Y.	F.	I.	Y.	F.	I.	Y.	F.	I.	Y.	F.	I.	Y.	F.	I.	Y.	F.	I.
1	0	0	3	0	0	4	6	0	6	0	0	7	6	0	9	0	0	10	6	0	12	0	0	13	6
1	6	0	4	6	0	6	9	0	9	0	0	11	3	0	13	6	0	15	9	0	18	0	0	20	3
2	0	0	6	0	0	9	0	0	12	0	0	15	0	0	18	0	0	21	0	0	24	0	1	0	0
2	6	0	7	6	0	11	3	0	15	0	0	18	9	0	22	6	0	26	3	1	3	0	1	6	9
3	0	0	9	0	0	13	6	0	18	0	0	22	6	1	0	0	1	4	6	1	9	0	1	13	6
3	6	0	10	6	0	15	9	0	21	0	0	26	3	1	4	6	1	9	9	1	15	0	1	20	3
4	0	0	12	0	0	18	0	0	24	0	1	3	0	1	9	0	1	15	0	1	21	0	2	0	0
4	6	0	13	6	0	20	3	1	0	0	1	6	9	1	13	6	1	20	3	2	0	0	2	6	9
5	0	0	15	0	0	22	6	1	3	0	1	10	6	1	18	0	1	25	6	2	6	0	2	13	6
5	6	0	16	6	0	24	9	1	6	0	1	14	3	1	22	6	2	3	9	2	12	0	2	20	3
6	0	0	18	0	1	0	0	1	9	0	1	18	0	2	0	0	2	9	0	2	18	0	3	0	0
6	6	0	19	6	1	2	3	1	12	0	1	21	9	2	4	6	2	14	3	2	24	0	3	6	9
7	0	0	21	0	1	4	6	1	15	0	1	25	6	2	9	0	2	19	6	3	3	0	3	13	6
7	6	0	22	6	1	6	9	1	18	0	2	2	3	2	13	6	2	24	9	3	9	0	3	20	3
8	0	0	24	0	1	9	0	1	21	0	2	6	0	2	18	0	3	0	0	3	15	0	4	0	0
8	6	0	25	6	1	11	3	1	24	0	2	9	9	2	22	6	3	5	3	3	21	0	4	6	9
9	0	1	0	0	1	13	6	2	0	0	2	13	6	3	0	0	3	10	6	4	0	0	4	13	6
9	6	1	1	6	1	15	9	2	3	0	2	17	3	3	4	6	3	15	9	4	6	0	4	20	3
10	0	1	3	0	1	18	0	2	6	0	2	21	0	3	9	0	3	21	0	4	12	0	5	0	0
10	6	1	4	6	1	20	3	2	9	0	2	24	9	3	13	6	3	26	3	4	18	0	5	6	9
11	0	1	6	0	1	22	6	2	12	0	3	1	6	3	18	0	4	4	6	4	24	0	5	13	6
11	6	1	7	6	1	24	9	2	15	0	3	5	3	3	22	6	4	9	9	5	3	0	5	20	3
12	0	1	9	0	2	0	0	2	18	0	3	9	0	4	0	0	4	15	0	5	9	0	6	0	0
12	6	1	10	6	2	2	3	2	21	0	3	12	9	4	4	6	4	20	3	5	15	0	6	6	9
13	0	1	12	0	2	4	6	2	24	0	3	16	6	4	9	0	4	25	6	5	21	0	6	13	6
13	6	1	13	6	2	6	9	3	0	0	3	20	3	4	13	6	5	3	9	6	0	0	6	20	3
14	0	1	15	0	2	9	0	3	3	0	3	24	0	4	18	0	5	9	0	6	6	0	7	0	0

Rule.—Add the width of the top and bottom together, half the sum is the average width, which look for in the side column, and look in the upper column for the depth, and in the column of intersection you have the solid contents, which multiply by the length, observing to carry 1 to the feet for every 12 inches, and 1 to the yards for every 27 feet.

No. II.

ADDITIONAL REMARKS ON FENCING.

In addition to the remarks on Fences, at pages 121, *et seq.*, it has been considered proper to add the following Notes, in regard to the expense of Stone-dikes, &c.

Most estates in the north of Scotland have quarries upon them, out of which stones for dikes can be got. If the quarry-rock is thick, and requires to be blasted with gunpowder, and broken with the mash and wedges, the expense of quarrying will be about 18s. for each rood of dike, of 36 square yards. If the rock is thin, and requires no gunpowder, the cost will be about 9s. per rood.

About 40 single cart-loads of stone will be required to each rood. Carriages may be stated on the following scale :—

Distance.		Per Rood of 36 yards.
10	Scots chains,	12/6
20	do.	14/
30	do.	16/
40	do.	18/6
50	do.	21/6
60	do.	25/

A table for ascertaining the number of roods in a dike, according to the height, will be afterwards given. If the carriages are not contracted for by the distance, but paid for by the time employed, 6d. per hour is counted fair payment for a man with a horse and cart.

If the stones are thick and large, or from a quarry which requires to be blasted, a double dike should be 2 feet 6 inches broad at bottom, 3 feet 6 inches high, and 1 foot 8 inches broad at top, over which there should be a coping of 9 inches. If the stones are thinner, they will answer to be 3 inches narrower. The expense of building is the same in either case, and varies from 10s. to 12s. per rood.

A sunk fence, 20 inches deep, with six feet of a sloping bank, can be cast and built for 3s. 4d. per rood, 36 yards lineal measure. Facing with stone can be done at 7s. per rood, of 36 yards square, exclusive of the cost of the stones, of which there is required for this purpose about two-thirds of what is used for a double dike. If the height be 4 feet, a hedge has a fine effect on the top of a sunk fence, and may be either of thorns or beech, or both. If mixed, two thorns and one beech, 9 inches apart, will make a good hedge.

Hedge-rows ought always to be planted in clean land, after fallow or green crop. If that cannot be done, the ground should be cleaned and manured with the spade before planting. If the fence be hedge and ditch, the size of the latter will, of course, be in proportion to the

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purpose it is intended to serve in regard to draining the land. When no drain is required but for the benefit of the hedge, a ditch 5 feet wide at top, 2 feet 6 inches deep, 1 foot wide at bottom, and 1 foot of scarsement, with all the earth formed into a bank of like dimensions, to back the hedge and protect it, is approved of. The margin betwixt the hedge-row and the ditch will depend on the depth of the latter. If 6 feet deep, the margin should be 1 foot 6 inches.

No. III.

CATALOGUE

OF THE

MEDIUM PRICES OF FOREST TREES

THROUGHOUT SCOTLAND FOR THE YEAR 1830.

	Price per			
	£	s.	d.	
Ash, Common,				
1 year seedling,	0	2	6	1000
3 year do.	0	3	0	...
transpl. 6 to 12 inches, .	0	7	6	...
1½ to 2 feet,	0	11	0	...
2 to 3 feet,	0	14	0	...
3 to 4 feet,	1	0	0	...
5 to 6 feet,	2	5	0	...
Ash, Mountain,				
1 year seedling,	0	2	6	...
2 year do.	0	3	0	...
transpl. 1 to 2 feet, .	0	18	0	...
2 to 3 feet,	1	0	0	...
3 to 4 feet,	1	5	0	...
4 to 6 feet,	1	15	0	...
Alder,				
1 year seedling,	0	2	6	...
2 year do.	0	3	6	...
transpl. 1 to 2 feet, .	0	7	6	...
2 to 3 feet,	0	14	0	...
4 to 6 feet,	1	0	0	...
Beech,				
1 year seedling,	0	2	6	...
2 year do.	0	3	6	...
transpl. 6 to 9 inches,	0	5	6	...
9 to 12 inches,	0	7	0	...
1 to 2 feet,	0	12	0	...
2 to 3 feet,	0	18	0	...
3 to 4 feet,	1	5	0	...
4 to 5 feet,	1	15	0	...

	Price per			
	£	s.	d.	1000
Birch, Common,				...
1 year seedling,	0	2	6	...
2 year do.	0	5	0	...
transpl. 6 to 12 inches,	0	10	0	...
1 to 2 feet,	0	15	0	...
2 to 3 feet,	0	18	0	...
3 to 4 feet,	1	0	0	...
4 to 5 feet,	1	5	0	...
Birch, Weeping,				
1 year seedling,	0	3	6	...
2 year do.	0	5	0	...
transpl. 6 to 12 inches,	0	7	6	...
1 to 2 feet.	0	15	0	...
2 to 3 feet,	1	0	0	...
3 to 4 feet,	1	5	0	...
4 to 5 feet,	1	10	0	...
Chesnut, Horse,				
1 year seedling,	0	4	6	...
2 year do.	0	6	0	...
transpl. 6 to 12 inches,	0	7	6	...
1 to 2 feet,	0	10	0	...
2 to 3 feet,	0	15	0	...
3 to 4 feet,	1	0	0	...
4 to 5 feet,	1	5	0	...
5 to 6 feet,	1	10	0	...
6 to 7 feet,	1	15	0	...
7 to 8 feet,	2	0	0	...
Chesnut, Spanish,				
1 year seedling,	0	10	0	...
2 year do.	0	15	0	...

	Price per			
	£	s.	d.	1000
Chesnut, Spanish,				
transpl. 6 to 12 inches,	1	0	0	...
1 to 2 feet,	1	5	0	...
2 to 3 feet,	1	7	6	...
3 to 4 feet,	1	10	0	...
4 to 5 feet,	1	12	6	...
5 to 6 feet,	1	15	0	...
6 to 7 feet,	2	0	0	...
7 to 8 feet,	2	10	0	...
Elm, Scots,				
1 year seedling,	0	3	6	
2 year do.	0	4	6	
transpl. 1 to 1½ feet,	0	7	6	
1½ to 2 feet,	0	10	0	
2 to 3 feet,	0	12	6	
3 to 4 feet,	0	18	0	
4 to 5 feet,	1	1	0	
5 to 6 feet,	1	6	0	
6 to 7 feet,	1	10	0	
7 to 8 feet,	1	15	0	
Elm, English,				
1 to 1½ feet,	0	5	0	100
2 to 3 feet,	0	7	6	...
3 to 4 feet,	0	18	0	...
4 to 5 feet,	1	0	0	...
5 to 6 feet,	1	5	0	...
6 to 8 feet,	1	7	6	...
Fir, Scots,				
1 year seedling,	0	0	4	1000
2 year do.	0	0	10	...
transpl. 1 year,	0	1	6	...
2 years,	0	2	6	...
Fir, Silver,				
1 year seedling,	0	3	0	...
2 year do.	0	4	6	...
transpl. 2 to 4 inches,	0	7	6	...
4 to 6 inches,	0	10	0	...
6 to 9 inches,	0	12	6	...
9 to 12 inches,	0	15	0	...
1 to 1½ feet,	0	18	0	...
1½ to 2 feet,	1	0	0	...
2 to 3 feet,	1	5	0	...
3 to 4 feet,	1	10	0	...
Fir, Norway Spruce,				
1 year seedling,	0	1	6	...
2 year do.	0	2	0	...
3 year do.	0	2	6	...
transpl. 2 to 4 inches,	0	3	6	...
4 to 6 inches,	0	4	0	...
6 to 9 inches,	0	7	6	...

	Price per			
	£	s.	d.	1000
Fir, Norway Spruce,				
transpl. 9 to 12 inches,	0	10	6	...
1 to 1½ feet,	0	18	0	..
1½ to 2 feet,	1	0	0	...
2 to 3 feet,	1	5	0	...
3 to 4 feet,	1	10	0	...
Fir, red Spruce,				
1 year seedling,	0	2	0	
2 year do.	0	3	6	
1 to 1½ feet,	0	7	6	
1½ to 2 feet,	0	10	6	
2 to 3 feet,	0	15	0	
Fir, white Spruce,				
1 year seedling,	0	2	0	
2 year do.	0	3	0	
transpl. 2 to 4 inches,	0	4	6	
4 to 6 inches,	0	6	0	
6 to 9 inches,	0	7	6	
1 to 1½ feet,	0	10	0	
1½ to 2 feet,	0	12	6	
2 to 3 feet,	0	18	0	
Fir, black Spruce,				
1 year seedling,	0	5	6	100
2 year do.	0	7	6	...
transpl. 3 to 6 inches,	0	10	0	...
6 to 9 inches,	0	12	6	...
9 to 12 inches,	0	15	0	...
1 to 1½ feet,	0	18	0	...
1 to 1½ feet,	1	0	0	...
2 to 3 feet,	1	1	0	...
Fir, Balm of Gilead,				
1 year seedling,	0	4	6	1000
2 year do.	0	6	0	...
transpl. 3 to 6 inches,	0	7	6	...
6 to 9 inches,	0	8	6	...
Hazel, Common,				
1 year seedling,	0	6	0	...
2 year do.	0	10	0	...
transpl. 6 to 12 inches,	0	1	6	100
1 to 1½ feet,	0	2	0	...
1½ to 2 feet,	0	2	6	...
2 to 3 feet,	0	3	0	...
3 to 4 feet,	0	4	6	...
4 to 5 feet,	0	6	0	...
5 to 6 feet,	0	7	6	...
Hornbeam,				
1 year seedling,	0	3	6	1000
2 year do.	0	4	6	...

	Price per £	s.	d.	
Hornbeam,				
transpl. 6 to 12 inches,	0	1	0	100
1 to 1½ feet,	0	1	6	...
1½ to 2 feet,	0	1	8	...
2 to 3 feet,	0	2	0	...
3 to 4 feet,	0	2	6	...
4 to 5 feet,	0	3	0	...
5 to 6 feet,	0	3	6	...
6 to 8 feet,	0	4	6	...
Laburnum, English,				
1 year seedling,	0	2	0	1000
2 year do.	0	3	6	...
transpl. 6 to 12 inches,	0	5	0	...
1 to 1½ feet,	0	6	0	...
1½ to 2 feet,	0	7	6	...
2 to 3 feet,	0	8	6	...
3 to 4 feet,	0	10	0	...
4 to 5 feet,	1	12	6	...
5 to 6 feet,	1	14	0	...
6 to 7 feet,	1	16	0	...
8 to 10 feet,	3	5	0	...
Laburnum, Scots,				
1 year seedling,	0	3	6	...
2 year do.	0	5	0	...
transpl. 6 to 12 inches,	0	7	6	...
1 to 1½ feet,	0	10	6	...
1½ to 2 feet,	0	15	0	...
2 to 3 feet,	0	18	0	...
3 to 4 feet,	1	5	0	...
4 to 5 feet,	2	7	6	...
5 to 6 feet,	2	10	0	...
6 to 7 feet,	2	15	0	...
Larch,				
1 year seedling,	0	1	6	...
2 year do.	0	2	0	...
3 year do.	0	2	6	...
transpl. 1 year,	0	3	6	...
2 year,	0	4	0	...
3 year,	0	4	6	...
2 to 3 feet,	0	5	0	...
3 to 4 feet,	0	6	0	...
Lime,				...
transpl. 1½ to 2 feet,	0	6	0	100
2 to 3 feet,	0	8	0	...
3 to 4 feet,	0	10	0	...
4 to 5 feet,	0	12	6	...
5 to 6 feet,	0	15	0	...
6 to 7 feet,	0	18	0	...
7 to 8 feet,	1	1	0	...
8 to 10 feet,	1	10	0	...

	Price per £	s.	d.	
Maple, English,				
1 year seedling,	0	5	0	1000
2 year do.	0	7	6	...
transpl. 1½ to 2 feet,	0	3	6	...
2 to 3 feet,	0	6	0	100
3 to 4 feet,	0	7	6	...
4 to 5 feet,	0	10	0	...
Maple, Swedish,				
1 year seedling,	0	6	0	1000
2 year do.	0	7	6	...
transpl. 1½ to 2 feet,	0	4	0	...
2 to 3 feet,	0	5	6	100
3 to 4 feet,	0	7	0	...
4 to 5 feet,	0	8	0	...
Oak,				
1 year seedling,	0	3	0	1000
2 year do.	0	4	0	...
transpl. 6 to 9 inches,	0	10	0	...
9 to 12 inches,	0	15	0	...
1½ to 2 feet,	0	18	0	...
2 to 3 feet,	1	5	0	...
3 to 4 feet,	1	10	0	
Oak, Turkey,				...
1 year seedling,	0	10	0	...
2 year do.	0	18	0	...
transpl. 1 to 1½ feet,	0	4	0	100
1½ to 2 feet,	0	4	6	...
2 to 3 feet,	0	5	0	...
3 to 4 feet,	0	6	0	...
4 to 6 feet,	0	7	0	...
6 to 8 feet,	0	10	0	...
Pine, Weymouth,				
1 year seedling,	0	5	0	...
2 year do.	0	7	6	...
transpl. 6 to 9 inches,	0	10	0	...
9 to 12 inches,	0	14	0	...
1 to 1½ feet,	0	15	0	...
1½ to 2 feet,	0	18	0	...
2 to 3 feet,	1	0	0	...
Pineaster,				
1 year seedling,	0	7	0	...
2 year do.	0	8	6	...
transpl. 3 to 9 in.	0	10	0	...
Pine, Cluster,				
1 year seedling,	0	5	0	...
2 year do.	0	7	6	...
transpl. 3 to 9 in.	0	10	0	...
1 to 1½ feet,	0	14	0	...
1½ to 2 feet,	0	16	0	..

	Price per			
	£	s.	d.	
Pine, Siberian, Stone,				
1 year seedling,	0	5	0	100
2 year do.	0	6	6	...
transpl. 6 to 9 in.	0	7	6	...
1 to 1½ feet,	0	10	0	...
Plane, or Sycamore,				
1 year seedling,	0	1	6	1000
2 year do.	0	2	6	...
transpl. 6 to 12 in.	0	5	0	...
1 to 1½ feet,	0	6	0	...
1½ to 2 feet,	0	1	6	100
2 to 3 feet,	0	2	0	...
3 to 4 feet,	0	2	6	...
4 to 5 feet,	0	3	6	...
5 to 6 feet,	0	4	0	...
6 to 8 feet,	0	5	0	...
Poplar, Black Italian,				
1½ to 2 feet,	0	1	6	...
3 to 4 feet,	0	2	6	...
4 to 5 feet,	0	3	6	...
5 to 6 feet,	0	4	4	...
6 to 8 feet,	0	6	0	...
8 to 10 feet,	0	10	0	...
Poplar, Lombardy,				
1½ to 2 feet,	0	1	6	...
2 to 3 feet,	0	2	0	...
3 to 4 feet,	0	2	6	...
4 to 5 feet,	0	3	0	...
5 to 6 feet,	0	4	0	...
6 to 8 feet,	0	6	0	...
8 to 10 feet,	0	12	0	...
Poplar, berry-bearing,				
1½ to 2 feet,	0	1	4	...
2 to 3 feet,	0	2	0	...
3 to 4 feet,	0	2	6	...
4 to 5 feet,	0	4	0	...
Poplar, hardy Carolina, 1½ to 2 feet,	0	1	0	...
2 to 3 feet,	9	1	6	...
3 to 4 feet,	0	2	6	...
4 to 5 feet,	0	3	0	...
5 to 6 feet,	0	5	0	...
6 to 8 feet,	0	7	0	...
8 to 10 feet,	0	9	0	...
Poplar, Egyptian,				
1½ to 2 feet,	0	1	0	...
2 to 3 feet,	0	2	0	...
3 to 4 feet,	0	4	6	...
4 to 5 feet,	0	5	0	...
5 to 6 feet,	0	6	0	...
6 to 8 feet,	0	7	6	...
8 to 10 feet,	0	9	0	...
Poplar, Common white, 1½ to 2 feet,	0	1	4	...
2 to 3 feet,	0	1	6	...

	Price per			
Poplar, com. white,				
3 to 4 feet,	0	2	0	100
4 to 5 feet,	0	4	0	...
5 to 6 feet,	0	5	0	...
6 to 8 feet,	0	6	0	...
8 to 10 feet,	0	7	6	...
Service,				
1 year seedling,	0	2	6	1000
2 year do.	0	4	6	...
transpl. 1 to 1½ ft.	0	1	6	100
1½ to 2 feet,	0	2	6	...
2 to 3 feet,	0	3	0	...
3 to 4 feet,	0	4	0	...
4 to 6 feet,	0	5	0	...
6 to 8 feet,	0	7	0	...
Sloe, or Blackthorn,				
1 year seedling,	0	7	0	1000
2 year do.	0	10	0	...
transpl. 1 to 1½ ft.	0	1	0	100
1½ to 2 feet,	0	2	0	...
2 to 3 feet,	0	2	6	...
3 to 4 feet,	0	3	6	...
4 to 6 feet,	0	4	0	...
Walnut,				
1 year seedling,	0	5	0	...
2 year do.	0	7	0	...
transpl. 6 to 12 inches,	0	3	0	...
1 to 1½ feet,	0	4	0	...
2 to 3 feet,	0	6	0	...
3 to 4 feet,	0	7	0	...
4 to 6 feet,	0	9	0	...
6 to 8 feet,	0	11	0	...
8 to 10 feet,	0	14	0	...
Willow, Huntingdon,				
2 to 3 feet,	0	1	0	...
3 to 4 feet,	0	1	6	...
4 to 6 feet,	0	2	6	...
Willow, Dutch,				
2 to 3 feet,	0	1	6	...
3 to 4 feet,	0	2	0	...
4 to 6 feet,	0	4	6	...
Willow, Norfolk,				
2 to 3 feet,	0	1	6	...
3 to 4 feet,	0	2	6	...
4 to 6 feet,	0	5	0	...
Willow, Bedford,				
2 to 3 feet,	0	1	0	...
3 to 4 feet,	0	3	6	...
4 to 6 feet,	0	4	0	...
Willow, for baskets, almond-leaved,	0	4	0	...
golden,	0	4	0	...
sweet-scented,	0	3	0	...

PLANTS FOR HEDGES.

	Price per £	s.	d.	
Barberry,				
1 year seedling,	0	4	0	1000
2 year do.	0	5	6	...
transpl. 2 to 3 feet,	0	9	0	...
3 to 4 feet,	0	10	6	...
Box, dwarf,	0	8	0	...
Box-tree, of sorts,	0	12	0	...
Briar, Sweet,				
1 year seedling,	0	5	0	...
2 year do.	0	6	0	...
transplanted,	0	10	0	...
Crab Apple, transplanted,	0	7	0	...
Holly,				
1 year seedling,	0	5	0	...
2 year do.	0	7	0	...
transpl. 3 to 6 in.	0	1	9	100
6 to 9 inches,	0	2	0	...
9 to 12 inches,	0	3	0	...
1 to 1½ feet,	0	4	0	...
1½ to 2 feet,	0	5	0	...
2 to 3 feet,	0	6	0	...
3 to 4 feet,	0	7	0	...

	Price per £	s.	d.	
Privet, Evergreen,				
transpl. 6 to 12 inches,	0	3	0	100
1 to 1½ feet,	0	4	0	...
1½ to 2 feet,	0	5	0	...
2 to 3 feet,	0	6	0	...
Thorn, quickset,				
1 year seedling,	0	2	6	1000
2 year do.	0	3	6	...
transpl. 1 year,	0	5	0	...
2 year do.	0	7	6	...
3 year do.	0	9	0	...
4 year do.	0	12	0	...
Yew,				
1 year seedling,	0	4	0	...
2 year do.	0	5	0	...
transpl. 3 to 6 in.	0	3	0	100
6 to 9 inches,	0	4	0	...
9 to 12 inches,	0	5	0	...
1½ to 2 feet,	0	6	0	...
2 to 3 feet,	0	7	0	...
3 to 4 feet,	0	10	0	...

No. IV.

CATALOGUE

OF

EVERGREEN AND FLOWERING SHRUBS,

ADAPTED FOR UNDERWOOD, WITH THEIR MEDIUM PRICES THROUGHOUT SCOTLAND, AT THE AGES PROPER FOR REMOVING THEM FROM THE NURSERY, FOR THE YEAR 1830.

	Price per			
	£	s.	d.	
Alaternus,				
common,	0	16	8	100
gold-blotched,	1	0	0	...
silver-striped,	1	0	0	...
gold-striped,	0	18	0	...
jagged-leaved,	0	16	0	...
silver-striped,	0	16	0	...
Arbor vitæ,				
common, .	1	5	0	...
Chinese, .	2	0	0	...
Arbutus,				
common or Strawberry tree,	1	0	0	...
red flowering,	1	5	0	...
double flowering,	1	7	6	...
eastern, .	2	15	0	...
alpine, .	2	15	0	...
fruiting, .	0	15	0	...
Barberry,				
red, .	0	10	0	...
white, .	0	10	0	...
Canadian,	0	15	0	...
Cretan, .	0	12	0	...
Birch tree,				
dwarf, .	0	5	0	...
hairy dwarf,	0	5	0	...
Bladder Nut,	0	10	0	...
three-leaved,	0	10	0	...
American,	0	12	0	...

	Price per			
	£	s.	d.	
Box thorn,				
willow-leaved,	0	10	0	100
Box-tree,				
common,	0	2	0	...
gold-edged,	0	5	0	...
curled-leaved,	0	6	6	...
striped-leaved,	0	7	0	...
blotched-leaved,	0	7	0	...
narrow-leaved,	0	5	0	...
Bramble,				
double flowering,	0	8	4	...
striped-leaved,	0	5	0	...
cut-leaved,	0	5	0	...
Buckthorn,				
common, .	0	4	6	...
dwarf, or yellow berried,	0	6	0	...
alder-leaved,	0	5	0	...
berry-bearing,	0	7	0	...
sea or Hippophaë,	0	7	0	...
Canadian,	0	8	0	...
Cherry, bird,				
common, .	0	6	0	...
Carolina striped,	0	8	4	...
Carolina ever-green,	0	8	4	...
Virginian,	0	10	0	...
dwarf Canadian,	0	8	4	...
black Canadian,	0	5	0	...

	Price per £	s.	d.	
Cherry,				
Cornish,	0	5	0	100
double flowering,	0	8	4	...
Crab-apple,				
paradise,	0	3	0	...
common,	0	2	6	...
scarlet-fruited Siberian,	0	16	0	...
transparent Siberian,	1	5	0	...
Virginian sweet-scented,	0	8	6	...
evergreen,	0	10	0	...
double flowering,	0	10	0	...
Cypress,				
upright,	1	5	0	...
spreading,	2	0	0	...
deciduous,	1	0	0	...
white cedar,	0	18	0	...
Cytisus,				
sessile-leaved or secundus,	0	14	0	...
hairy, or evergreen,	0	14	0	...
black,	0	16	0	...
Dogwood,				
white berried,	0	10	0	...
great flowering,	0	7	0	...
female or cornelian,	0	8	4	...
upright,	0	8	4	...
striped leaved,	0	12	0	...
red twigged,	0	8	0	...
New Holland,	0	8	6	...
Elder,				
common black-berried,	0	8	4	...
parsley leaved,	0	5	0	...
green berried,	0	5	0	...
red berried,	0	5	0	...
swamp or Canadian,	0	6	0	...
gold striped,	0	8	0	...
silver striped,	0	6	0	...
Elm,				
drooping,	1	10	0	...
hornbeam leaved,	2	0	0	...
dwarf Siberian,	1	5	0	...
Evergreen Thorn or Pyracantha,	1	4	0	...
Gale, sweet-scented, or Dutch Myrtle,	0	8	4	...
broad-leaved American,	0	8	4	...

	Price per £	s.	d.	
Guelder-Rose, marsh or common,	0	8	0	100
Virginian,	0	8	0	...
snowball or doub.	0	10	6	
striped-leaved,	0	10	6	...
Honeysuckle,				
common,	0	8	6	...
long blowing,	0	8	6	...
early red,	0	8	6	...
early white,	0	8	6	...
late white,	0	8	6	...
red Dutch,	0	8	6	...
early pale yellow,	0	8	6	...
oak-leav. striped,	0	12	0	...
evergreen,	1	0	0	...
Minorca do.	2	10	0	...
Virginian,	0	10	0	...
trumpet,	0	12	6	...
Newfoundland or lesser trumpet,	0	10	0	...
black-berried upright,	0	8	6	...
Tartarian do.	0	8	6	...
Pyrenean do.	0	8	4	...
blue-berried do.	0	8	4	...
fly,	0	5	0	...
St Peter's-wort,	0	6	0	...
yellow flowering,	0	6	0	...
Holly,				
common green,	0	5	0	...
white berried do.	0	6	0	...
yellow berried do.	0	8	0	...
smooth-leaved,	0	5	0	...
saw-leaved,	0	5	0	...
green hedgehog,	0	8	0	...
striped-leaved,	2	10	0	...
Juniper,				
common,	0	8	0	...
English,	0	8	0	...
creeping,	0	10	0	...
Swedish,	0	6	0	...
Spanish,	0	8	0	...
brown berried,	0	6	0	...
Virginian red cedar,	0	10	0	...
Ivy,				
common,	0	10	0	...
striped-leaved,	1	5	0	...
2-leaved, or Virginian creeper,	0	15	0	...
small leaved,	0	10	0	...
Laurel, Bay,				
common,	0	16	8	...
broad-leaved,	0	16	8	...

	Price per £	s.	d.	
Laurel, Bay,				
striped-leaved,	1	4	0	100
narrow-leaved,	0	16	8	...
Portugal,	0	16	8	...
striped Portugal,	1	4	0	...
Laurustinus,				
common,	0	10	0	...
striped leaved do.	0	12	0	...
shining-leaved,	0	12	0	...
hairy shining lea.	0	10	0	...
Lilac,				
blue, .	0	10	0	...
purple, .	0	10	0	...
white, .	0	12	0	...
striped-leaved,	1	0	0	...
blue Persian,	0	10	0	...
white Persian,	0	10	0	...
cut-leaved do.	0	10	0	...
Periwinkle,				
large green,	0	8	4	...
small green,	0	8	4	...
double flowering,	0	8	4	...
white flowering,	0	7	6	...
silver-striped,	0	10	0	...
gold-striped,	0	10	0	...
Privet,				
common,	0	8	0	...
evergreen,	0	8	0	...
silver-striped,	0	10	0	...
gold-striped,	0	10	0	...
Rose,				
double white,	1	5	0	...
white dog,	0	10	0	...
alpine, .	0	12	0	...
red Belgic,	0	10	0	...
blush Belgic,	0	10	0	...
dwarf blush,	0	8	0	...
crimson Burgundy, .	0	9	0	...
dog or hap tree,	0	8	0	...
cinnamon,	0	8	0	...
double do.	0	10	0	...
damask, .	0	8	0	...
double damask,	0	10	0	...
blush, double,	0	8	0	...
sweetbriar,	0	5	0	...
semidouble red,	0	5	0	...
double red sweetbriar, .	0	6	6	...
evergreen sweetbriar, .	0	10	0	...
Rose-mundi, or striped,	0	8	4	...
double velvet,	0	10	0	...

	Price per £	s.	d.	
Rose,				
maiden's blush, .	0	8	0	100
great do.	0	8	0	...
thornless,	0	7	6	...
single yellow,	0	5	0	...
double yellow,	0	5	0	...
red and yellow Austrian,	0	8	0	...
dwarf Austrian,	0	8	6	...
double marbled,	0	10	0	...
doub. red monthly, .	0	10	0	...
double blush do.	0	5	0	...
single musk,	0	7	6	...
double musk,	0	8	0	...
single Pensylvanian, .	0	8	4	...
double do.	0	12	0	...
single Provence or cabbage,	0	5	0	...
double Provence,	0	7	6	...
double white do.	0	7	6	...
double blush do.	0	7	6	...
Childing's Provence,	0	8	0	...
moss Provence,	1	5	0	...
great royal,	0	10	0	...
evergreen,	0	10	0	...
single red Scots,	0	5	0	...
single white do.	0	5	0	...
single marbled do.	0	7	6	...
double white do.	0	10	0	...
Sumach,				
Virginian,	0	10	0	...
stag-horn, red fl.	0	10	0	...
smooth leaved,	0	8	4	...
Carolinian,	0	10	0	...
varnish-tree,	1	0	0	...
Syringa,				
tall, or Mock orange,	0	8	0	...
dwarf, .	0	8	0	...
Carolinian,	0	10	0	...
Thorn,				
great American,	0	16	0	...
maple-leaved,	1	0	0	...
pear-leaved,	1	0	0	...
olive-leaved,	1	0	0	...
holly-leaved,	0	16	0	...
hollow-pear berried, .	0	16	0	...
gooseberry-leav.	0	12	0	...
great fruited,	1	0	0	...
cockspur,	0	16	0	...

	Price per £	s.	d.			Price per £	s.	d.	
Thorn,					Virgin's-bower,				
Pyracantha-leav.	0	12	0	100	evergreen,	1	15	0	100
willow-leaved,	1	5	0	...	large flowering,	1	15	0	...
parsley-leaved,	1	5	0	...	sweet-scented,	1	15	0	...
jagged,	0	12	0	...	Virginian,	0	18	0	...
double flowering,	0	16	0	...	curled flowered,	1	5	0	...
yellow-berried,	0	12	0	...	common, or Traveller's joy,	0	16	0	..
Glastonbury,	0	10	0	...	single purple,	1	5	0	...
scarlet flowering,	0	10	0	...	double purple,	1	10	0	...
					single red,	0	16	0	...

No. V.

TABLES

FOR

MEASURING TIMBER, AND STONE DIKES, AND FOR ASCERTAINING THE NUMBER OF TREES TO BE PLANTED IN AN ACRE.

EXPLANATION OF TABLE I.

This Table requires little explanation, as every one must know that the length and girth of the tree must be taken before the contents can be known. If a tree tapers equally from the bottom to the top, take the girth in the middle, and divide it by four, which gives, what is technically called by measurers, the side of the square; that is, when the tree is measured after the bark is cut off, or after an allowance is given for it, which is generally 1 inch out of $\frac{1}{4}$th of the whole girth; as, if $\frac{1}{4}$th of the girth, including the bark, be 9 inches, then 1 inch is deducted, and $\frac{1}{4}$th of the girth is only counted 8 inches. But when trees taper unequally, it will be necessary to take the girth at different places, add them all together, and divide the amount by the number of times you have taken the girth. Suppose you have taken 6 girths, dividing by 6 gives a mean girth, and, dividing the mean by 4, gives the side of the square.

The side of the square is marked in inches on the left-hand side of the Table, and the length, in feet, at the top; the solid contents are found at the angle of intersection. For example, if the length of a tree be 20 feet, the girth 40 inches, $\frac{1}{4}$th of which is 10 inches for the side of the square; then look at the top of the table for 20 feet, and in the same column, opposite to 10 inches in the side of the square, you will find the solid contents of the tree to be 13 feet $10\frac{1}{2}$ inches.

TABLE I.

For ascertaining the Number of Solid Feet in any Tree, from 1 to 42 Feet long, and from 4 to 40 Inches in the Side of the Square.

From 4 to 40 inches in Side of the Square, and from 1 to 6 feet long.

¼th of Girth.	1 Foot Long.		2 Feet Long.		3 Feet Long.		4 Feet Long.		5 Feet Long.		6 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
4	0	1⅓	0	2⅔	0	4	0	5⅓	0	6⅔	0	8
4½	0	1⅔	0	3⅓	0	5	0	6¾	0	$8\frac{5}{12}$	0	$10\frac{1}{12}$
5	0	$2\frac{1}{12}$	0	4⅙	0	6¼	0	8⅓	0	$10\frac{5}{12}$	1	0½
5½	0	2½	0	5	0	7½	0	$10\frac{1}{12}$	1	$0\frac{7}{12}$	1	$3\frac{1}{12}$
6	0	3	0	6	0	9	1	0	1	3	1	6
6½	0	3½	0	7	0	10½	1	2	1	5½	1	9¼
7	0	4	0	8¼	1	0¼	1	4¼	1	8½	2	0½
7½	0	4½	0	9¼	1	2	1	6¾	1	11½	2	4
8	0	5¼	0	10¾	1	4	1	9¼	2	2¾	2	8
8½	0	6	1	0	1	6	2	0	2	6	3	0
9	0	6¾	1	1½	1	8¼	2	3	2	9¾	3	4½
9½	0	7½	1	3	1	10½	2	6	3	1½	3	9
10	0	8¼	1	4½	2	1	2	9¼	3	5¾	4	2
10½	0	9¼	1	6¼	2	3½	3	0¾	3	9¾	4	7
11	0	10	1	8¼	2	6¼	3	4¼	4	2½	5	0½
11½	0	11	1	10	2	9	3	8	4	7	5	6¼
12	1	0	2	0	3	0	4	0	5	0	6	0
12½	1	1	2	2	3	3	4	4	5	5	6	6¼
13	1	2	2	4¼	3	6¼	4	8¼	5	10¼	7	0½
13½	1	3¼	2	6¼	3	9½	5	0¾	6	3¾	7	7
14	1	4¼	2	8½	4	1	5	5¼	6	9½	8	2
14½	1	5½	2	11	4	4½	5	10	7	3½	8	9
15	1	6¾	3	1½	4	8¼	6	3	7	9¾	9	4½
15½	1	8	3	4	5	0	6	8	8	4	10	0
16	1	9¼	3	6¾	5	4	7	1¼	8	10½	10	8
16½	1	10¾	3	9¼	5	8	7	6¾	9	5½	11	4
17	2	0	4	0	6	0¼	8	0¼	10	0½	12	0½
17½	2	1½	4	3	6	4½	8	6	10	7½	12	9
18	2	3	4	6	6	9	9	0	11	3	13	6
18½	2	4½	4	9	7	1½	9	6	11	10½	14	3
19	2	6	5	0	7	6¼	10	0¼	12	6½	15	0½
19½	2	7¾	5	3½	7	11	10	6¾	13	2½	15	10
20	2	9¼	5	6½	8	4	11	1¼	13	10½	16	8
20½	2	11	5	10	8	9	11	8	14	7	17	6
21	3	0¾	6	1½	9	2¼	12	3	15	3¾	18	4½
21½	3	2½	6	5	9	7½	12	10	16	0½	19	3

From 1 to 6 Feet long.—*continued.*

¼th of Girth.	1 Foot Long.		2 Feet Long.		3 Feet Long.		4 Feet Long.		5 Feet Long.		6 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
22	3	4⅓	6	8⅔	10	1	13	5⅓	16	9⅔	20	2
22½	3	6	7	0⅓	10	6½	14	0¾	17	7	21	1
23	3	$8\frac{1}{12}$	7	4⅙	11	0¼	14	8⅓	18	$4\frac{5}{12}$	22	0½
23½	3	10	7	8	11	6	15	$4\frac{1}{12}$	19	$2\frac{1}{12}$	23	$0\frac{1}{12}$
24	4	0	8	0	12	0	16	0	20	0	24	0
24½	4	2	8	4	12	6	16	$8\frac{1}{12}$	20	$10\frac{1}{12}$	25	$0\frac{1}{12}$
25	4	$4\frac{1}{12}$	8	8⅙	13	0¼	17	4⅓	21	$8\frac{5}{12}$	26	0½
25½	4	6⅙	9	0⅓	13	6½	18	0¾	22	$6\frac{11}{12}$	27	$1\frac{1}{12}$
26	4	8⅓	9	4⅔	14	1	18	9⅓	23	5⅔	28	2
26½	4	10½	9	9	14	7½	19	$6\frac{1}{12}$	24	$4\frac{7}{12}$	29	$3\frac{1}{12}$
27	5	0¾	10	1½	15	2¼	20	3	25	3¾	30	4½
27½	5	3	10	6	15	9	21	$0\frac{1}{12}$	26	$3\frac{1}{12}$	31	$6\frac{1}{12}$
28	5	5⅓	10	10⅔	16	4	21	9⅓	27	2⅔	32	8
28½	5	7⅔	11	3⅓	16	11	22	6¾	28	$2\frac{5}{12}$	33	$10\frac{1}{12}$
29	5	$10\frac{1}{12}$	11	8⅙	17	6¼	23	4⅓	29	$2\frac{5}{12}$	35	0½
29½	6	0½	12	1	18	1½	24	$2\frac{1}{12}$	30	$2\frac{7}{12}$	36	$3\frac{1}{12}$
30	6	3	12	6	18	9	25	0	31	3	37	6
30½	6	5½	12	11	19	4½	25	$10\frac{1}{12}$	32	$3\frac{7}{12}$	38	$9\frac{1}{12}$
31	6	$8\frac{1}{12}$	13	4⅙	20	0¼	26	8⅓	33	$4\frac{5}{12}$	40	0½
31½	6	10⅔	13	9⅓	20	8	27	6¾	34	$5\frac{5}{12}$	41	$4\frac{1}{12}$
32	7	1⅓	14	2⅔	21	4	28	5⅓	35	6⅔	42	8
32½	7	4	14	8	22	0	29	$4\frac{1}{12}$	36	$8\frac{1}{12}$	44	$0\frac{1}{12}$
33	7	6¾	15	1½	22	8¼	30	3	37	9¾	45	4½
33½	7	9½	15	7	23	4½	31	$2\frac{1}{12}$	38	$11\frac{7}{12}$	46	$9\frac{1}{12}$
34	8	0⅓	16	0⅔	24	1	32	1⅓	40	1⅔	48	2
34½	8	3⅙	16	6⅓	24	9½	33	1¾	41	$3\frac{11}{12}$	49	$7\frac{1}{12}$
35	8	$6\frac{1}{12}$	17	0⅙	25	6¼	34	10⅓	42	$6\frac{5}{12}$	51	0½
35½	8	9	17	6	26	3	35	$0\frac{1}{12}$	43	$9\frac{1}{12}$	52	$6\frac{1}{12}$
36	9	0	18	0	27	0	36	0	45	0	54	0
36½	9	3	18	6	27	9	37	$0\frac{1}{12}$	46	$3\frac{1}{12}$	55	$6\frac{1}{12}$
37	9	$6\frac{1}{12}$	19	0⅙	28	6¼	38	0⅓	47	$6\frac{5}{12}$	57	0½
37½	9	9⅙	19	6⅓	29	3½	39	0¾	48	$9\frac{11}{12}$	58	$7\frac{1}{12}$
38	10	0⅓	20	0⅔	30	1	40	1⅓	50	1⅔	60	2
38½	10	3½	20	7	30	10½	41	$2\frac{1}{12}$	51	$5\frac{7}{12}$	61	$9\frac{1}{12}$
39	10	6¾	21	1½	31	8¼	42	3	52	9¾	63	4½
39½	10	10	21	8	32	6	43	$4\frac{1}{12}$	54	$2\frac{1}{12}$	65	$0\frac{1}{12}$
40	11	1⅓	22	2⅔	33	4	44	5⅓	55	6⅔	66	8

TABLE I.—*continued.*

From 7 to 12 Feet long.

¼th of Girth.	7 Feet Long.	8 Feet Long.	9 Feet Long.	10 Feet Long.	11 Feet Long.	12 Feet Long.
I.	F. I.	F. I.	F. I.	F. I.	F. I.	F. I.
4	0 9⅓	0 10⅔	1 0	1 1⅓	1 2⅔	1 4
4½	0 11¾	1 1½	1 3¼	1 4⅞	1 6⅝	1 8¼
5	1 2$\frac{7}{12}$	1 4⅔	1 6¾	1 8⅚	1 10$\frac{11}{12}$	2 1
5½	1 5$\frac{7}{12}$	1 8⅙	1 10⅔	2 1⅕	2 3¾	2 6¼
6	1 9	2 0	2 3	2 6	2 9	3 0
6½	2 0$\frac{7}{12}$	2 4⅙	2 7⅔	2 11⅕	3 2¾	3 6¼
7	2 4½	2 8⅔	3 0¾	3 4⅚	3 9	4 1
7½	2 8¾	3 1½	3 6¼	3 10⅞	4 3⅝	4 8¼
8	3 1⅓	3 6⅔	4 0	4 5⅓	4 10⅔	5 4
8½	3 6	4 0	4 6¼	5 0	5 6¼	6 0¼
9	3 11¼	4 6	5 0¾	5 7½	6 2¼	7 6¼
9½	4 4⅔	5 0	5 7½	6 3	6 10¾	7 6¼
10	4 10⅓	5 6⅔	6 3	6 11⅓	7 7⅔	8 4
10½	5 4¼	6 1½	6 10¾	7 7⅞	8 5	9 2¼
11	5 10½	6 8⅔	7 6¾	8 4⅚	9 3	10 1
11½	6 5	7 4	8 3¼	9 2¼	10 1¼	11 0¼
12	7 0	8 0	9 0	10 0	11 0	12 0
12½	7 7	8 8¼	9 9	10 10¼	11 11¼	13 0¼
13	8 2½	9 4⅔	10 6¾	11 8¾	12 10¾	14 1
13½	8 10¼	10 1½	11 4¾	12 7¾	13 11	15 2¼
14	9 6⅓	10 10⅔	12 3	13 7⅓	14 11⅔	16 4
14½	10 2½	11 8¼	13 1¾	14 7	16 0⅝	17 6¼
15	10 11¼	12 6	14 0¾	15 7½	17 2¼	18 9
15½	11 8	13 4	15 0	16 8¼	18 4¼	20 0¼
16	12 5⅓	14 2⅔	15 11¾	17 9⅓	19 6⅔	21 4
16½	13 2¾	15 1½	17 0	18 10¾	20 9⅝	22 8¼
17	14 0	16 0⅔	18 0¾	20 0¾	22 0⅞	24 0¾
17½	14 10	17 0	19 1¾	21 3	23 4¾	25 6¼
18	15 9	18 0	20 3	22 6	24 9	27 0
18½	16 7½	19 0	21 4¾	23 9	26 1¾	28 6¼
19	17 6½	20 0¾	22 6¾	25 0¾	27 6¾	30 0¾
19½	18 5¾	21 1½	23 9	26 4¾	29 0½	31 8¼
20	19 5⅓	22 2⅔	24 11¾	27 9⅓	30 6⅔	33 4
20½	20 5$\frac{1}{12}$	23 4⅙	26 3⅙	29 2⅙	32 1⅙	35 0¼
21	21 5¼	24 6	27 6⅔	30 7½	33 8¼	36 9
21½	22 5$\frac{7}{12}$	25 8⅙	28 10⅔	32 1⅙	35 3⅗	38 6¼
22	23 6⅓	26 10⅔	30 3	33 7⅓	36 11⅔	40 4
22½	24 7¼	28 1½	31 7⅔	35 1⅝	38 8	42 2¼
23	25 8$\frac{7}{12}$	29 4⅔	33 0¾	36 8⅚	40 4$\frac{11}{12}$	44 1
23½	26 10$\frac{1}{12}$	30 8⅙	34 6	38 4⅙	42 2⅙	46 0¼
24	28 0	32 0	36 0	40 0	44 0	48 0

From 7 to 12 Feet long.—*continued.*

¼th of Girth.	7 Feet Long.		8 Feet Long.		9 Feet Long.		10 Feet Long.		11 Feet Long.		12 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
24½	29	2 1/12	33	4⅙	37	6 3/16	41	8⅙	45	10⅓	50	0¼
25	30	4 7/12	34	8⅔	39	0¾	43	4⅚	47	8 11/12	52	1
25½	31	7⅓	36	1½	40	7 11/16	45	1⅞	49	8	54	2¼
26	32	10⅓	37	6⅔	42	3	46	11⅓	51	7⅔	56	4
26½	34	1 7/12	39	0⅙	43	10 11/16	48	9⅙	53	7⅝	58	6¼
27	35	5¼	40	6	45	6	50	7½	55	8¼	60	9
27½	36	9 1/12	42	0⅙	47	3¼	52	6⅙	57	9½	63	0¼
28	38	1⅓	43	6⅔	49	0	54	5⅓	59	10⅔	65	0¼
28½	39	5¾	45	1½	50	9¼	56	4⅞	62	0⅝	67	8¼
29	40	10 7/12	46	8⅔	52	6¾	58	4⅚	64	2 11/12	70	1
29½	42	3 7/12	48	4⅙	54	4¾	60	5⅙	66	5¾	72	6¼
30	43	9	50	0	56	3	62	6	68	9	75	0
30½	45	2 7/12	51	8⅙	58	1⅔	64	7⅙	71	0¾	77	6¼
31	46	8 7/12	53	4⅔	60	0¾	66	8⅚	73	4 11/12	80	1
31½	48	2¾	55	1½	62	0 3/16	68	10⅞	75	9⅝	82	8¼
32	49	9⅓	56	10⅔	64	0	71	1⅓	78	2⅔	85	4
32½	51	4 1/12	58	8⅙	66	0 3/16	73	4⅙	80	8¼	88	0¼
33	52	11¼	60	6	68	0¾	75	7½	83	2¼	90	9
33½	54	6 7/12	62	4⅙	70	1 11/16	77	11⅙	85	8¾	95	6¼
34	56	2⅓	64	2⅔	72	3	80	3⅓	88	3⅔	96	4
34½	57	10¼	66	1½	74	4 11/16	82	7⅞	90	11	99	2¼
35	59	6 7/12	68	0⅔	76	6¾	85	0⅚	93	6 11/12	102	1
35½	61	3 1/12	70	0⅙	78	9 3/16	87	6⅙	96	3¼	105	0¼
36	63	0	72	0	81	0	90	0	99	0	108	0
36½	64	9 1/12	74	0⅙	83	3 3/16	92	6⅙	101	9¼	111	0¼
37	66	6 7/12	76	0⅔	85	6¾	95	0⅚	104	6 11/12	114	1
37½	68	4¼	78	1½	87	10 11/16	97	7⅞	107	5	117	2¼
38	70	2⅓	80	2⅔	90	3	100	3⅓	110	3⅔	120	4
38½	72	0 7/12	82	4⅙	92	7 11/16	102	11⅙	113	2⅝	123	6¼
39	73	11¼	84	6	95	0¾	105	7½	116	2¼	126	9
39½	75	10 1/12	86	8⅙	97	6 3/16	108	4⅙	119	2¼	130	0¼
40	77	9⅓	88	10⅔	100	0	111	1⅓	122	2⅔	133	4

TABLE I.—*continued.*

From 13 to 18 Feet long.

¼th of Girth.	13 Feet Long.		14 Feet Long.		15 Feet Long.		16 Feet Long.		17 Feet Long.		18 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
4	1	$5\frac{1}{3}$	1	$6\frac{2}{3}$	1	8	1	$9\frac{1}{3}$	1	$10\frac{2}{3}$	2	0
$4\frac{1}{2}$	1	$9\frac{11}{12}$	1	$11\frac{7}{12}$	2	$1\frac{1}{4}$	2	3	2	$4\frac{2}{3}$	2	$6\frac{3}{8}$
5	2	$3\frac{1}{12}$	2	$5\frac{1}{6}$	2	$7\frac{1}{4}$	2	$9\frac{1}{3}$	2	$11\frac{5}{12}$	3	$1\frac{1}{2}$
$5\frac{1}{2}$	2	$8\frac{3}{4}$	2	$11\frac{1}{4}$	3	$1\frac{3}{4}$	3	$4\frac{1}{3}$	3	$6\frac{5}{6}$	3	$9\frac{3}{8}$
6	3	3	3	6	3	9	4	0	4	3	4	6
$6\frac{1}{2}$	3	$8\frac{3}{4}$	4	$1\frac{1}{4}$	4	$4\frac{3}{4}$	4	$8\frac{1}{3}$	4	$11\frac{5}{6}$	5	$3\frac{3}{8}$
7	4	$5\frac{1}{12}$	4	$9\frac{1}{6}$	5	$1\frac{1}{4}$	5	$5\frac{1}{3}$	5	$9\frac{5}{12}$	6	$1\frac{1}{2}$
$7\frac{1}{2}$	5	$0\frac{11}{12}$	5	$5\frac{7}{12}$	5	$10\frac{1}{4}$	6	3	6	$7\frac{2}{3}$	7	$0\frac{3}{8}$
8	5	$9\frac{1}{3}$	6	$2\frac{2}{3}$	6	8	7	$1\frac{1}{3}$	7	$6\frac{2}{3}$	8	0
$8\frac{1}{2}$	6	$6\frac{1}{4}$	7	$0\frac{1}{4}$	7	$6\frac{1}{4}$	8	$0\frac{1}{3}$	8	$6\frac{1}{3}$	9	$0\frac{3}{8}$
9	7	$3\frac{3}{4}$	7	$10\frac{1}{2}$	8	$5\frac{1}{4}$	9	0	9	$6\frac{3}{4}$	10	$1\frac{1}{2}$
$9\frac{1}{2}$	8	$1\frac{3}{4}$	8	$9\frac{1}{4}$	9	$4\frac{3}{4}$	10	$0\frac{1}{3}$	10	$7\frac{5}{6}$	11	$3\frac{3}{8}$
10	9	$0\frac{1}{3}$	9	$8\frac{2}{3}$	10	5	11	$1\frac{1}{3}$	11	$9\frac{2}{3}$	12	6
$10\frac{1}{2}$	9	$11\frac{5}{12}$	10	$8\frac{7}{12}$	11	$5\frac{3}{4}$	12	3	13	$0\frac{1}{6}$	13	$9\frac{3}{8}$
11	10	$11\frac{1}{12}$	11	$9\frac{1}{6}$	12	$7\frac{1}{4}$	13	$5\frac{1}{3}$	14	$3\frac{5}{12}$	15	$1\frac{1}{2}$
$11\frac{1}{2}$	11	$11\frac{1}{4}$	12	$10\frac{1}{4}$	13	$9\frac{1}{4}$	14	$8\frac{1}{3}$	15	$7\frac{1}{3}$	16	$6\frac{3}{8}$
12	13	0	14	0	15	0	16	0	17	0	18	0
$12\frac{1}{2}$	14	$1\frac{1}{4}$	15	$2\frac{1}{4}$	16	$3\frac{1}{4}$	17	$4\frac{1}{3}$	18	$5\frac{1}{3}$	19	$6\frac{3}{8}$
13	15	$3\frac{1}{12}$	16	$5\frac{1}{6}$	17	$4\frac{1}{4}$	18	$9\frac{1}{3}$	19	$11\frac{5}{12}$	21	$1\frac{1}{2}$
$13\frac{1}{2}$	16	$5\frac{5}{12}$	17	$8\frac{7}{12}$	18	$11\frac{3}{4}$	20	3	21	$6\frac{1}{6}$	22	$9\frac{3}{8}$
14	17	$8\frac{1}{3}$	19	$0\frac{2}{3}$	20	5	21	$9\frac{1}{3}$	23	$1\frac{2}{3}$	24	6
$14\frac{1}{2}$	18	$11\frac{3}{4}$	20	$5\frac{1}{4}$	21	$10\frac{3}{4}$	23	$4\frac{1}{3}$	24	$9\frac{5}{6}$	26	$3\frac{3}{8}$
15	20	$3\frac{3}{4}$	21	$10\frac{1}{2}$	23	$5\frac{1}{4}$	25	0	26	$6\frac{3}{4}$	28	$1\frac{1}{2}$
$15\frac{1}{2}$	21	$8\frac{1}{4}$	23	$4\frac{1}{4}$	25	$0\frac{1}{4}$	26	$8\frac{1}{3}$	28	$4\frac{1}{3}$	30	$0\frac{3}{8}$
16	23	$1\frac{1}{3}$	24	$10\frac{2}{3}$	26	8	28	$5\frac{1}{3}$	30	$2\frac{2}{3}$	32	0
$16\frac{1}{2}$	24	$6\frac{11}{12}$	26	$5\frac{7}{12}$	28	$4\frac{1}{4}$	30	3	32	$1\frac{2}{3}$	34	$0\frac{3}{8}$
17	26	$1\frac{1}{12}$	28	$1\frac{1}{6}$	30	$1\frac{1}{4}$	32	$1\frac{1}{3}$	34	$1\frac{5}{12}$	36	$1\frac{1}{2}$
$17\frac{1}{2}$	27	$7\frac{3}{4}$	29	$9\frac{5}{12}$	31	$10\frac{3}{4}$	34	$0\frac{1}{3}$	36	$1\frac{5}{6}$	38	$3\frac{3}{8}$
18	29	3	31	6	33	9	36	0	38	3	40	6
$18\frac{1}{2}$	30	$10\frac{3}{4}$	33	$3\frac{1}{4}$	35	$7\frac{3}{4}$	38	$0\frac{1}{3}$	40	$4\frac{5}{6}$	42	$9\frac{3}{8}$
19	32	$7\frac{1}{12}$	35	$1\frac{1}{6}$	37	$7\frac{1}{4}$	40	$1\frac{1}{3}$	42	$7\frac{5}{12}$	45	$1\frac{1}{2}$
$19\frac{1}{2}$	34	$3\frac{11}{12}$	36	$11\frac{7}{12}$	39	$7\frac{1}{4}$	42	3	44	$10\frac{2}{3}$	47	$6\frac{3}{8}$
20	36	$1\frac{1}{3}$	38	$10\frac{2}{3}$	41	8	44	$5\frac{1}{3}$	47	$2\frac{2}{3}$	50	0
$20\frac{1}{2}$	37	$11\frac{1}{4}$	40	$10\frac{1}{4}$	43	$9\frac{1}{4}$	46	$8\frac{1}{3}$	49	$7\frac{1}{3}$	52	$6\frac{3}{8}$
21	39	$9\frac{3}{4}$	42	$10\frac{1}{2}$	45	$11\frac{1}{4}$	49	0	52	$0\frac{3}{4}$	55	$1\frac{1}{2}$
$21\frac{1}{2}$	41	$8\frac{3}{4}$	44	$11\frac{1}{4}$	48	$1\frac{3}{4}$	51	$4\frac{1}{3}$	54	$6\frac{5}{6}$	57	$9\frac{3}{8}$
22	43	$8\frac{1}{4}$	47	$0\frac{2}{3}$	50	5	53	$9\frac{1}{3}$	57	$1\frac{2}{3}$	60	6
$22\frac{1}{2}$	45	$8\frac{5}{12}$	49	$2\frac{7}{12}$	52	$8\frac{3}{4}$	56	3	59	$9\frac{1}{6}$	63	$3\frac{3}{8}$
23	47	$9\frac{1}{12}$	51	$5\frac{1}{6}$	55	$1\frac{1}{4}$	58	$9\frac{1}{3}$	62	$5\frac{5}{12}$	66	$1\frac{1}{2}$
$23\frac{1}{2}$	49	$10\frac{1}{4}$	53	$8\frac{1}{4}$	57	$6\frac{1}{4}$	61	$4\frac{1}{3}$	65	$2\frac{1}{3}$	69	$0\frac{3}{8}$
24	52	0	56	0	60	0	64	0	68	0	72	0

From 13 to 18 Feet long.—*continued.*

¼th of Girth.	13 Feet Long.		14 Feet Long.		15 Feet Long.		16 Feet Long.		17 Feet Long.		18 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
24½	54	2¼	58	4¼	62	6¼	66	8⅓	70	10⅓	75	4⅜
25	56	$5\frac{1}{12}$	60	9⅙	65	1¼	69	5⅓	53	$9\frac{5}{12}$	78	1½
25½	58	$8\frac{5}{12}$	63	$2\frac{7}{12}$	67	8¾	72	3	76	9⅙	81	3⅜
26	61	0⅓	65	8⅔	70	5	75	1⅓	79	9⅔	84	6
26½	63	4¾	68	3¼	73	1¾	78	0⅓	82	10⅚	87	9⅜
27	65	9¾	70	10½	75	11¼	81	0	86	0¾	91	1½
27½	68	3¼	73	6¼	78	9¼	84	0⅓	89	3⅓	94	6⅜
28	70	9⅓	76	2⅔	81	8	87	1⅓	92	6⅔	98	0
28½	73	$3\frac{11}{12}$	78	$11\frac{7}{12}$	84	7¼	90	3	95	10⅔	101	6⅜
29	75	$11\frac{1}{12}$	81	9⅙	87	7¼	93	5⅓	99	3⅚	105	1½
29½	78	6¾	84	7¼	90	7¾	96	8⅓	102	8⅚	108	9⅜
30	81	3	87	6	93	6	100	0	106	3	112	6
30½	83	11¾	90	5¼	96	10¾	103	4⅓	109	9⅚	116	3⅜
31	86	$9\frac{1}{12}$	93	5⅙	100	1¼	106	9⅓	113	$5\frac{5}{12}$	120	1½
31½	89	$6\frac{11}{12}$	96	$5\frac{7}{12}$	103	4¼	110	3	117	1⅔	124	0⅜
32	92	5⅓	99	6⅔	106	8	113	9⅓	120	10⅔	128	0
32½	95	4¼	102	3¼	110	0¼	117	4⅓	124	8⅓	132	0⅜
33	98	3¾	105	10½	113	5¼	121	0	128	6¾	136	1½
33½	101	3¾	109	1¼	116	10¾	124	8⅓	132	5⅚	140	3⅜
34	104	4⅓	112	4⅔	120	5	128	5⅓	136	5⅔	144	6
34½	107	$5\frac{5}{12}$	115	$8\frac{7}{12}$	123	11¾	132	3	140	6⅙	148	9⅜
35	110	$7\frac{1}{12}$	119	1⅙	127	7¼	136	1⅓	144	$7\frac{5}{12}$	153	1½
35½	113	9¼	122	6¼	131	3¼	140	0⅓	148	9⅓	157	6⅜
36	117	0	126	0	135	0	144	0	153	0	162	0
36½	120	3¼	129	6¼	138	9¼	148	0⅓	157	3⅓	166	6⅜
37	123	$7\frac{1}{12}$	133	1⅙	142	7¼	152	1⅓	161	$7\frac{5}{12}$	171	1½
37½	126	$11\frac{5}{12}$	136	$8\frac{7}{12}$	146	5¾	156	3	166	0⅙	175	9⅜
38	130	4⅓	140	4⅔	150	5	160	5⅓	170	5⅔	180	6
38½	133	9¾	144	1¼	154	4¾	164	8⅓	174	11⅚	185	3⅜
39	137	3¾	147	10½	158	5¼	169	0	179	6¾	190	1½
39½	140	10¼	151	8¼	162	6¼	173	4⅓	184	2⅓	195	0⅜
40	144	5⅓	155	6⅔	166	8	177	9⅓	188	10⅔	200	0

TABLE I.—*continued.*

From 19 to 24 Feet long.

$\frac{1}{4}$th the Girth.	19 Feet Long.		20 Feet Long.		21 Feet Long.		22 Feet Long.		23 Feet Long.		24 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
4	2	$1\frac{1}{3}$	2	$2\frac{2}{3}$	2	4	2	$5\frac{1}{3}$	2	$6\frac{2}{3}$	2	8
$4\frac{1}{2}$	2	8	2	$9\frac{3}{4}$	2	$11\frac{5}{12}$	3	$1\frac{1}{12}$	3	$2\frac{3}{4}$	3	$4\frac{1}{2}$
5	3	$3\frac{7}{12}$	3	$5\frac{2}{3}$	3	$7\frac{3}{4}$	3	$9\frac{10}{12}$	3	$11\frac{11}{12}$	4	2
$5\frac{1}{2}$	3	$11\frac{7}{8}$	4	$2\frac{5}{12}$	4	$4\frac{11}{12}$	4	$7\frac{5}{12}$	4	$9\frac{11}{12}$	5	$0\frac{1}{2}$
6	4	9	5	0	5	3	5	6	5	9	6	0
$6\frac{1}{2}$	5	$6\frac{3}{4}$	5	$10\frac{1}{3}$	6	$1\frac{3}{4}$	6	$5\frac{1}{4}$	6	$8\frac{3}{4}$	7	$0\frac{1}{2}$
7	6	$5\frac{1}{2}$	6	$9\frac{2}{3}$	7	$1\frac{3}{4}$	7	$5\frac{3}{4}$	7	$9\frac{3}{4}$	8	2
$7\frac{1}{2}$	7	5	7	$9\frac{3}{4}$	8	$2\frac{1}{4}$	8	7	8	$11\frac{3}{4}$	9	$4\frac{1}{2}$
8	8	$5\frac{1}{4}$	8	$10\frac{1}{3}$	9	4	9	$9\frac{1}{4}$	10	$2\frac{1}{2}$	10	8
$8\frac{1}{2}$	9	$6\frac{1}{4}$	10	$0\frac{1}{4}$	10	$6\frac{1}{4}$	11	$0\frac{1}{8}$	11	$6\frac{1}{4}$	12	$0\frac{1}{2}$
9	10	$8\frac{1}{4}$	11	3	11	$9\frac{3}{4}$	12	$4\frac{1}{2}$	12	$11\frac{1}{4}$	13	6
$9\frac{1}{2}$	11	$10\frac{3}{4}$	12	$6\frac{1}{4}$	13	$1\frac{3}{4}$	13	$9\frac{1}{4}$	14	$4\frac{3}{4}$	15	$0\frac{1}{2}$
10	13	$2\frac{1}{4}$	13	$10\frac{1}{3}$	14	7	15	$3\frac{1}{4}$	15	$11\frac{1}{8}$	16	8
$10\frac{1}{2}$	14	$6\frac{1}{2}$	15	$3\frac{3}{4}$	16	1	16	10	17	$7\frac{1}{2}$	18	$4\frac{1}{2}$
11	15	$11\frac{1}{3}$	16	$9\frac{1}{3}$	17	$7\frac{3}{4}$	18	$5\frac{3}{4}$	19	4	20	2
$11\frac{1}{2}$	17	$5\frac{1}{4}$	18	$4\frac{1}{4}$	19	$3\frac{1}{4}$	20	$2\frac{1}{4}$	21	$1\frac{1}{4}$	22	$0\frac{1}{2}$
12	19	0	20	0	21	0	22	0	23	0	24	0
$12\frac{1}{2}$	20	$7\frac{1}{4}$	21	$8\frac{1}{4}$	22	$9\frac{1}{4}$	23	$10\frac{1}{4}$	24	$11\frac{1}{4}$	26	0
13	22	$3\frac{1}{2}$	23	$5\frac{1}{3}$	24	$7\frac{3}{4}$	25	$9\frac{3}{4}$	27	0	28	2
$13\frac{1}{2}$	24	0	25	$3\frac{3}{4}$	26	7	27	10	29	$1\frac{1}{4}$	30	$4\frac{1}{2}$
14	25	$10\frac{1}{3}$	27	$2\frac{1}{3}$	28	7	29	$11\frac{1}{4}$	31	3	32	8
$14\frac{1}{2}$	27	$8\frac{3}{4}$	29	$2\frac{1}{4}$	30	8	32	$1\frac{1}{4}$	33	7	35	$0\frac{1}{2}$
15	29	$8\frac{1}{4}$	31	3	32	$9\frac{3}{4}$	34	$4\frac{1}{2}$	35	$11\frac{3}{4}$	37	6
$15\frac{1}{2}$	31	$8\frac{1}{4}$	33	$4\frac{1}{4}$	35	$0\frac{1}{8}$	36	8	38	4	40	0
16	33	$9\frac{1}{4}$	35	$6\frac{3}{4}$	37	4	39	$1\frac{1}{4}$	40	$10\frac{3}{4}$	42	8
$16\frac{1}{2}$	35	$1\frac{1}{4}$	37	$9\frac{3}{4}$	39	$8\frac{1}{4}$	41	7	43	$5\frac{3}{4}$	45	$4\frac{1}{2}$
17	38	$1\frac{1}{2}$	40	$1\frac{3}{4}$	42	$1\frac{3}{4}$	44	$1\frac{3}{4}$	46	2	48	2
$17\frac{1}{2}$	40	$4\frac{3}{4}$	42	$6\frac{1}{4}$	44	8	46	$9\frac{1}{4}$	48	11	50	$0\frac{1}{2}$
18	42	9	45	0	47	3	49	6	51	9	54	0
$18\frac{1}{2}$	45	$1\frac{3}{4}$	47	$6\frac{1}{4}$	49	11	52	$3\frac{1}{4}$	54	8	57	$0\frac{1}{2}$
19	47	$7\frac{1}{2}$	50	$1\frac{3}{4}$	52	$7\frac{3}{4}$	55	$1\frac{3}{4}$	57	8	60	2
$19\frac{1}{2}$	50	2	52	$9\frac{3}{4}$	55	$5\frac{1}{4}$	58	1	60	$8\frac{3}{4}$	63	$4\frac{1}{2}$
20	52	$9\frac{1}{4}$	55	$6\frac{3}{4}$	58	4	61	$1\frac{1}{4}$	63	$10\frac{3}{4}$	66	8
$20\frac{1}{2}$	55	$5\frac{1}{3}$	58	$4\frac{5}{12}$	61	$3\frac{5}{12}$	64	$2\frac{5}{12}$	67	$1\frac{5}{12}$	70	$0\frac{1}{2}$
21	58	$2\frac{1}{4}$	61	3	64	$3\frac{3}{4}$	67	$4\frac{1}{2}$	70	$5\frac{1}{4}$	73	6
$21\frac{1}{2}$	60	$11\frac{5}{8}$	64	$2\frac{5}{12}$	67	$4\frac{11}{12}$	70	$7\frac{5}{12}$	73	$9\frac{11}{12}$	77	$0\frac{1}{2}$
22	63	$10\frac{1}{3}$	67	$2\frac{2}{3}$	70	7	73	$11\frac{1}{3}$	77	$3\frac{2}{3}$	80	8
$22\frac{1}{2}$	66	$9\frac{1}{2}$	70	$3\frac{3}{4}$	73	$9\frac{11}{12}$	77	$4\frac{1}{12}$	80	$10\frac{1}{4}$	84	$4\frac{1}{2}$
23	69	$9\frac{7}{12}$	73	$5\frac{2}{3}$	77	$1\frac{3}{4}$	80	$9\frac{5}{8}$	84	$5\frac{11}{12}$	88	2
$23\frac{1}{2}$	72	$10\frac{1}{3}$	76	$8\frac{5}{12}$	80	$6\frac{5}{12}$	84	$4\frac{5}{12}$	88	$2\frac{5}{12}$	92	$0\frac{1}{2}$
24	76	0	80	0	84	0	88	0	92	0	96	0

From 18 to 24 Feet—continued.

[illegible]	[illegible] Feet Long.		[illegible] Feet Long.		[illegible] Feet Long.		[illegible] Feet Long.		23 Feet Long.		24 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	91	[illegible]	97	10[illegible]	100	0½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	95	[illegible]	99	11	104	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99	4[illegible]	103	10½	108	4½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	103	3½	107	11½	112	8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	107	3[illegible]	112	1[illegible]	117	0½
[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	[illegible]	111	4[illegible]	116	5¼	121	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	115	6[illegible]	120	9[illegible]	126	0½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	119	9½	125	2½	130	8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	124	1[illegible]	129	8½	135	4½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	128	5½	134	3[illegible]	140	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	132	11[illegible]	138	11[illegible]	145	0½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	137	6	143	9	150	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	142	1[illegible]	148	6[illegible]	155	0½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1½	146	9½	153	5[illegible]	160	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	151	7[illegible]	158	5½	165	4½
[illegible]	[illegible]	[illegible]	[illegible]	2½	[illegible]	4	156	5½	163	6½	170	8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	154	[illegible]	161	4[illegible]	168	8[illegible]	176	0½
[illegible]	[illegible]	[illegible]	[illegible]	3	158	9½	166	4½	173	11½	181	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	163	7[illegible]	171	5[illegible]	179	2[illegible]	187	0½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	168	7	176	7½	184	7½	192	8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	173	6[illegible]	181	10[illegible]	190	1½	198	4½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	178	7½	187	1½	195	7[illegible]	204	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	183	9[illegible]	192	6[illegible]	201	3[illegible]	210	0½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	198	0	207	0	216	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]	203	6[illegible]	212	9[illegible]	222	0½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	209	1½	218	7[illegible]	228	2
[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]	[illegible]	[illegible]	214	10[illegible]	224	7½	234	4½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	210	7	220	7½	230	7½	240	8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	216	1[illegible]	226	5[illegible]	236	8[illegible]	247	0½
[illegible]	200	[illegible]	211	3	221	9[illegible]	232	4½	242	11½	253	6
[illegible]	205	[illegible]	[illegible]	[illegible]	227	6[illegible]	238	4[illegible]	249	2[illegible]	260	0½
47	211	[illegible]	222	2½	233	4	244	5½	255	6½	266	8

TABLE I.—*continued.*

From 25 to 30 Feet long.

¼th of Girth.	25 Feet Long.		26 Feet Long.		27 Feet Long.		28 Feet Long.		29 Feet Long.		30 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
4	2	9⅓	2	10⅔	3	0	3	1⅓	3	2⅔	3	4
4½	3	6⅛	3	7⅜	3	9½	3	11¼	4	0 15/16	4	2 7/12
5	4	4 1/12	4	6⅓	4	8¼	4	10⅓	5	0 5/12	5	2⅛
5½	5	3	5	5⅛	5	8	5	10 7/12	6	1 1/12	6	3 7/12
6	6	3	6	6	6	9	7	0	7	3	7	6
6½	7	4	7	7⅛	7	11	8	2 7/12	8	6 1/12	8	9 7/12
7	8	6 1/12	8	10⅓	9	2¼	9	6⅓	9	10 5/12	10	2⅛
7½	9	9⅛	10	1⅝	10	6½	10	11¼	11	3 15/16	11	8 7/12
8	11	1⅛	11	6⅔	12	0	12	5⅛	12	10	13	4
8½	12	6⅛	13	0⅛	13	6½	14	0 7/12	14	6 7/12	15	0 7/12
9	14	0¾	14	7⅛	15	2¼	15	9	16	3¾	16	10⅛
9½	15	8	16	3⅛	16	11	17	6 7/12	18	2 1/12	18	9 7/12
10	17	4⅓	18	0⅔	18	9	19	5⅓	20	1⅔	20	10
10½	19	1⅜	19	10	20	8	21	5¼	22	2 5/12	22	11 7/12
11	21	0 1/12	21	10⅓	22	8½	23	6⅓	24	4 5/12	25	2⅛
11½	22	11⅛	23	10⅛	24	9½	25	8 7/12	26	7 7/12	27	6 7/12
12	25	0	26	0	27	0	28	0	29	0	30	0
12½	27	1⅛	28	2⅛	29	3½	30	4 7/12	31	5 7/12	32	6 7/12
13	29	4 1/12	30	6⅓	31	8¼	32	10⅓	34	0 5/12	35	2⅛
13½	31	7⅜	32	10⅝	34	2	35	5⅛	36	8 5/12	37	11 7/12
14	34	0⅛	35	4⅔	36	9	38	1⅓	39	5⅔	40	10
14½	36	6	37	11⅛	39	5	40	10 7/12	42	4 1/12	43	9 7/12
15	39	0⅜	40	7⅛	42	2¼	43	9	45	3¾	46	10⅛
15½	41	8⅛	43	4⅛	45	0½	46	8 7/12	48	4 7/12	50	0 7/12
16	44	5⅓	46	2⅔	48	0	49	9⅓	51	6⅔	53	4
16½	47	3⅓	49	1⅝	51	0½	52	11¼	54	9 15/16	56	8 7/12
17	50	2 1/12	52	2⅓	54	2¼	56	2⅓	58	2 5/12	60	2⅛
17½	53	2	55	3⅛	57	5	59	6 7/12	61	8 1/12	63	9 7/12
18	56	3	58	6	60	9	63	0	65	3	67	6
18½	59	5	61	9⅛	64	2	66	6 7/12	68	11 1/12	71	3 7/12
19	62	8 1/12	65	2⅓	67	8¼	70	2⅓	72	8 5/12	75	2⅛
19½	66	0⅛	68	7⅝	71	3½	73	11¼	76	6 15/16	79	2 7/12
20	69	5⅓	72	2⅔	75	0	77	9⅓	80	6⅔	83	4
20½	72	11⅛	75	10⅛	78	9½	81	8 7/12	84	7 7/12	87	6 7/12
21	76	6¾	79	7⅛	82	8¼	85	9	88	9¾	91	10⅛
21½	80	3	83	5⅛	86	8	89	10 7/12	93	1 1/12	96	3 7/12
22	84	0⅓	87	4⅔	90	9	94	1⅓	97	5⅔	100	10
22½	87	10⅜	91	4⅝	94	11	98	5¼	100	11 5/12	105	5 7/12
23	91	10 1/12	95	6⅛	99	2¼	102	10⅓	106	6 5/12	110	2⅛
23½	95	10⅛	99	8⅛	103	6½	107	4 7/12	111	2 7/12	115	0 7/12
24	100	0	104	0	108	0	112	0	116	0	180	0

From 25 to 30 Feet—*continued.*

[illegible]	25 Feet Long.		26 Feet Long.		27 Feet Long.		28 Feet Long.		29 Feet Long.		30 Feet Long.	
[illegible]	F.	L.	F.	L.	F.	L.	F.	L.	F.	L.	F.	L.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	116	2	120	10	125	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	121	6	125	10	130	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	126	3	130	11	135	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	131	5	136	1	140	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	136	6	141	5	146	3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	141	9	146	9	151	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	147	0	152	3	157	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	152	5	157	10	163	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	157	11	163	6	169	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	163	6	169	4	175	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	169	2	175	3	181	3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	175	0	181	3	187	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	180	10	187	4	193	9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	186	10	193	6	200	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	192	11	199	9	206	8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	199	1	206	2	213	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	205	4	212	8	220	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	211	9	219	3	226	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	218	2	[illegible]	0	233	9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	232	9	240	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	231	5	239	8	247	11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	246	8	255	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245	0	253	9	262	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	261	0	270	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	268	3	277	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	275	6	285	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	273	[illegible]	283	2	292	11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	291	9	300	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	6	308	9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	306	3	316	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	303	4	314	2	325	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	311	1	322	2	333	4

TABLE I.—*continued.*

From 31 to 36 Feet long.

¼th of Girth.	31 Feet Long.		32 Feet Long.		33 Feet Long.		34 Feet Long.		35 Feet Long.		36 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
4	3	$5\frac{1}{3}$	3	$6\frac{2}{3}$	3	8	3	$9\frac{1}{3}$	3	$10\frac{2}{3}$	4	0
$4\frac{1}{2}$	4	$4\frac{1}{4}$	4	6	4	$7\frac{3}{4}$	4	$9\frac{3}{8}$	4	11	5	$0\frac{3}{4}$
5	5	$4\frac{7}{12}$	5	$6\frac{2}{3}$	5	$8\frac{3}{4}$	5	$10\frac{5}{6}$	6	$0\frac{2}{3}\frac{1}{4}$	6	3
$5\frac{1}{2}$	6	$6\frac{1}{12}$	6	$8\frac{2}{3}$	6	$11\frac{1}{4}$	7	$1\frac{2}{3}$	7	$4\frac{1}{4}$	7	$6\frac{3}{4}$
6	7	9	8	0	8	3	8	6	8	9	9	0
$6\frac{1}{2}$	9	$1\frac{1}{12}$	9	$4\frac{2}{3}$	9	$8\frac{1}{4}$	9	$11\frac{2}{3}$	10	$3\frac{1}{4}$	10	$6\frac{3}{4}$
7	10	$6\frac{7}{12}$	10	$10\frac{2}{3}$	11	$2\frac{3}{4}$	11	$6\frac{5}{6}$	11	$10\frac{2}{3}\frac{1}{4}$	12	3
$7\frac{1}{2}$	12	$1\frac{1}{4}$	12	6	12	$10\frac{3}{4}$	13	$3\frac{3}{8}$	13	8	14	$0\frac{3}{4}$
8	13	$9\frac{1}{3}$	14	$2\frac{2}{3}$	14	8	15	$1\frac{1}{3}$	15	$6\frac{2}{3}$	16	0
$8\frac{1}{2}$	15	$6\frac{7}{12}$	16	$0\frac{2}{3}$	16	$6\frac{3}{4}$	17	$0\frac{2}{3}$	17	$6\frac{3}{4}$	18	$0\frac{3}{4}$
9	17	$5\frac{1}{4}$	18	0	18	$6\frac{3}{4}$	19	$1\frac{1}{2}$	19	$8\frac{1}{4}$	20	3
$9\frac{1}{2}$	19	$5\frac{1}{12}$	20	$0\frac{2}{3}$	20	$8\frac{1}{4}$	21	$3\frac{2}{3}$	21	$11\frac{1}{4}$	22	$6\frac{3}{4}$
10	21	$6\frac{1}{3}$	22	$2\frac{2}{3}$	23	$7\frac{1}{3}$	24	$3\frac{2}{3}$	25	0	25	$8\frac{1}{3}$
$10\frac{1}{2}$	23	$8\frac{3}{4}$	24	6	25	$3\frac{1}{4}$	26	$0\frac{3}{8}$	26	$9\frac{1}{2}$	27	$6\frac{3}{4}$
11	26	$0\frac{7}{12}$	26	$10\frac{2}{3}$	27	$8\frac{3}{4}$	28	$6\frac{5}{6}$	29	$4\frac{2}{3}\frac{1}{4}$	30	3
$11\frac{1}{2}$	28	$5\frac{7}{12}$	29	$4\frac{2}{3}$	30	$3\frac{3}{4}$	31	$2\frac{2}{3}$	32	$1\frac{3}{4}$	33	$0\frac{3}{4}$
12	31	0	32	0	33	0	34	0	35	0	36	0
$12\frac{1}{2}$	33	$7\frac{7}{12}$	34	$8\frac{2}{3}$	35	$9\frac{3}{4}$	36	$10\frac{2}{3}$	37	$11\frac{2}{3}$	39	$0\frac{3}{4}$
13	36	$4\frac{7}{12}$	37	$6\frac{2}{3}$	38	$8\frac{3}{4}$	39	$10\frac{5}{6}$	41	$0\frac{2}{3}\frac{1}{4}$	42	3
$13\frac{1}{2}$	30	$2\frac{3}{4}$	40	6	41	$9\frac{1}{4}$	43	$0\frac{3}{8}$	44	$3\frac{1}{2}$	45	$6\frac{3}{4}$
14	42	$2\frac{1}{3}$	43	$6\frac{2}{3}$	44	11	46	$3\frac{1}{3}$	47	$7\frac{2}{3}$	49	0
$14\frac{1}{2}$	45	$3\frac{1}{12}$	46	$8\frac{2}{3}$	48	$2\frac{1}{4}$	49	$7\frac{2}{3}$	51	$1\frac{1}{4}$	52	$6\frac{3}{4}$
15	48	$5\frac{1}{4}$	50	0	51	$6\frac{3}{4}$	53	$1\frac{1}{2}$	54	$8\frac{1}{4}$	56	3
$15\frac{1}{2}$	51	$8\frac{7}{12}$	53	$4\frac{2}{3}$	55	$0\frac{3}{4}$	56	$8\frac{2}{3}$	58	$4\frac{2}{3}$	60	$0\frac{3}{4}$
16	55	$1\frac{1}{3}$	56	$10\frac{2}{3}$	58	8	60	$5\frac{1}{3}$	62	$2\frac{2}{3}$	64	0
$16\frac{1}{2}$	58	$7\frac{1}{4}$	60	6	62	$4\frac{3}{4}$	64	$3\frac{3}{8}$	66	2	68	$0\frac{3}{4}$
17	62	$2\frac{7}{12}$	64	$2\frac{2}{3}$	66	$2\frac{3}{4}$	68	$2\frac{5}{6}$	70	$2\frac{2}{3}\frac{1}{4}$	72	3
$17\frac{1}{2}$	65	$11\frac{1}{12}$	68	$0\frac{2}{3}$	70	$2\frac{1}{4}$	72	$3\frac{2}{3}$	74	$5\frac{1}{4}$	76	$6\frac{3}{4}$
18	69	9	72	0	74	3	76	6	78	9	81	0
$18\frac{1}{2}$	73	$8\frac{1}{12}$	76	$0\frac{2}{3}$	78	$5\frac{1}{4}$	80	$9\frac{2}{3}$	83	$2\frac{1}{4}$	85	$6\frac{3}{4}$
19	77	$8\frac{7}{12}$	80	$2\frac{2}{3}$	82	$8\frac{3}{4}$	85	$2\frac{5}{6}$	87	$8\frac{2}{3}\frac{1}{4}$	90	3
$19\frac{1}{2}$	81	$10\frac{1}{4}$	84	6	87	$1\frac{3}{4}$	89	$9\frac{3}{8}$	92	5	95	$0\frac{3}{4}$
20	86	$1\frac{1}{3}$	88	$10\frac{2}{3}$	91	8	94	5	97	$2\frac{2}{3}$	100	0
$20\frac{1}{2}$	90	$5\frac{7}{12}$	93	$4\frac{2}{3}$	96	$3\frac{3}{4}$	99	$2\frac{2}{3}$	102	$1\frac{3}{4}$	105	$0\frac{3}{4}$
21	94	$11\frac{1}{4}$	98	0	101	$0\frac{3}{4}$	104	$0\frac{1}{2}$	107	$2\frac{1}{4}$	110	3
$21\frac{1}{2}$	99	$6\frac{1}{12}$	102	$8\frac{2}{3}$	105	$11\frac{1}{4}$	109	$1\frac{2}{3}$	112	$4\frac{1}{4}$	115	$6\frac{3}{4}$
22	104	$2\frac{1}{3}$	107	$6\frac{2}{3}$	110	11	114	$3\frac{1}{3}$	117	$7\frac{2}{3}$	121	0
$22\frac{1}{2}$	108	$11\frac{3}{4}$	112	6	116	$0\frac{1}{4}$	119	$6\frac{3}{8}$	123	$0\frac{1}{2}$	126	$6\frac{3}{4}$
23	113	$10\frac{7}{12}$	117	$6\frac{2}{3}$	121	$2\frac{3}{4}$	124	$10\frac{5}{6}$	128	$6\frac{2}{3}\frac{1}{4}$	131	3
$23\frac{1}{2}$	118	$10\frac{7}{12}$	122	$8\frac{2}{3}$	126	$6\frac{3}{4}$	130	$4\frac{2}{3}$	134	$2\frac{3}{4}$	138	$0\frac{3}{4}$
24	124	0	128	0	132	0	136	0	140	0	144	0

From 31 to 36 Feet long—*continued.*

¼th of Girth.	31 Feet Long.		32 Feet Long.		33 Feet Long.		34 Feet Long.		35 Feet Long.		36 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
24½	129	2 7/12	133	4⅔	137	6⅔	141	8⅔	145	10⅔	150	0¾
25	134	6 7/12	138	10⅔	143	2¾	147	6⅚	151	10 11/12	156	3
25½	139	11¾	144	6	149	0⅙	153	6⅓	158	0½	162	6¾
26	145	6⅓	150	2⅔	154	11	159	7⅓	164	3⅔	169	0
26½	151	2 1/12	156	0⅔	160	11⅙	165	9⅔	170	8½	175	6¾
27	156	11¼	162	0	167	0¾	172	1½	177	2¼	182	3
27½	162	9 7/12	168	0⅔	173	3⅔	178	6⅚	183	9⅔	189	0¾
28	168	9⅓	174	2⅔	179	8	185	1⅓	190	6⅔	196	0
28½	174	10¼	180	6	186	1⅔	191	9⅓	197	5	203	0¾
29	181	0 7/12	186	10⅔	192	8¾	198	6⅚	204	4 11/12	210	3
29½	187	4 1/12	193	4⅔	199	5⅙	205	5⅚	211	6⅙	217	6¾
30	193	9	200	0	206	3	212	6	218	9	225	0
30½	200	3 1/12	206	8⅔	213	2⅙	219	7⅚	226	1½	232	6¾
31	206	10 7/12	213	6⅔	220	2¾	226	10⅚	233	6 11/12	240	3
31½	213	7¼	220	6	227	4⅔	234	3⅓	241	2	248	0¾
32	222	5⅓	227	6⅔	234	8	241	9⅓	248	10⅔	256	0
32½	227	4 7/12	234	8⅔	242	0⅔	249	4⅚	256	8⅔	264	0¾
33	234	5¼	242	0	249	6⅔	257	1½	264	8¼	272	3
33½	241	7 1/12	249	4⅔	257	2⅙	264	11⅚	272	9½	280	6¾
34	248	10⅓	256	10⅔	264	11	272	11⅓	280	11⅔	289	0
34½	256	2¾	264	6	272	9⅙	281	0⅓	289	3½	297	6¾
35	263	8 7/12	272	2⅔	280	8¾	289	2⅚	297	8 11/12	306	3
35½	271	3 7/12	280	0⅔	288	9⅔	297	6⅚	306	3⅔	315	0¾
36	279	0	288	0	297	0	306	0	315	0	324	0
36½	286	9 7/12	296	0⅔	305	3⅔	314	6⅚	323	9⅔	333	0¾
37	294	8 7/12	304	2⅔	313	8¾	323	2⅚	332	8 11/12	342	3
37½	302	8¾	312	6	322	3⅙	332	0⅓	341	9½	351	6¾
38	310	10⅓	320	10⅔	330	11	340	11⅓	350	11⅔	361	0
38½	319	1 1/12	329	4⅔	339	8⅙	349	11⅚	360	3½	370	6¾
39	327	5¼	338	0	348	6¾	359	1½	369	8¼	380	3
39½	335	10 7/12	346	8⅔	357	6⅔	368	4⅚	379	2⅔	390	0¾
40	344	5⅓	355	6⅔	366	8	377	9⅓	388	10⅔	400	0

TABLE I.—*continued.*

From 37 to 42 Feet long.

¼th of Girth.	37 Feet Long.		38 Feet Long.		39 Feet Long.		40 Feet Long.		41 Feet Long.		42 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
4	4	$1\frac{1}{3}$	4	$2\frac{2}{3}$	4	4	4	$5\frac{1}{3}$	4	$6\frac{2}{3}$	4	8
$4\frac{1}{2}$	5	$2\frac{5}{12}$	5	$4\frac{1}{12}$	5	$5\frac{3}{4}$	5	$7\frac{1}{2}$	5	$9\frac{1}{6}$	5	$10\frac{7}{8}$
5	6	$5\frac{1}{12}$	9	$7\frac{1}{6}$	6	$9\frac{1}{4}$	6	$11\frac{1}{3}$	7	$1\frac{5}{12}$	7	$3\frac{1}{2}$
$5\frac{1}{2}$	7	$9\frac{1}{4}$	7	$11\frac{3}{4}$	8	$2\frac{1}{4}$	8	$4\frac{5}{6}$	8	$7\frac{1}{3}$	8	$9\frac{7}{8}$
6	9	3	9	6	9	9	10	0	10	3	10	6
$6\frac{1}{2}$	10	$10\frac{1}{4}$	11	$1\frac{3}{4}$	11	$5\frac{1}{4}$	11	$8\frac{5}{6}$	12	$0\frac{1}{3}$	12	$3\frac{7}{8}$
7	12	$7\frac{1}{12}$	12	$11\frac{1}{6}$	13	$3\frac{1}{4}$	13	$7\frac{1}{3}$	13	$11\frac{5}{12}$	14	$3\frac{1}{2}$
$7\frac{1}{2}$	14	$5\frac{5}{12}$	14	$10\frac{1}{12}$	15	$2\frac{3}{4}$	15	$7\frac{1}{2}$	16	$0\frac{1}{6}$	16	$4\frac{7}{8}$
8	16	$5\frac{1}{3}$	16	$10\frac{2}{3}$	17	4	17	$9\frac{1}{3}$	18	$2\frac{2}{3}$	18	8
$8\frac{1}{2}$	18	$6\frac{3}{4}$	19	$0\frac{3}{4}$	19	$6\frac{3}{4}$	20	$0\frac{5}{6}$	20	$6\frac{5}{6}$	21	$0\frac{7}{8}$
9	20	$9\frac{3}{4}$	21	$4\frac{1}{2}$	21	$11\frac{1}{4}$	22	6	23	$0\frac{3}{4}$	23	$7\frac{1}{2}$
$9\frac{1}{2}$	23	$2\frac{1}{4}$	23	$9\frac{3}{4}$	24	$5\frac{1}{4}$	25	$0\frac{5}{6}$	25	$8\frac{1}{3}$	26	$3\frac{7}{8}$
10	25	$8\frac{1}{3}$	26	$4\frac{2}{3}$	27	1	27	$9\frac{1}{3}$	28	$5\frac{2}{3}$	29	2
$10\frac{1}{2}$	28	$3\frac{11}{12}$	29	$1\frac{1}{12}$	29	$10\frac{1}{4}$	30	$7\frac{1}{2}$	31	$4\frac{2}{3}$	32	$1\frac{7}{8}$
11	31	$1\frac{1}{12}$	31	$11\frac{1}{6}$	32	$9\frac{1}{4}$	33	$7\frac{1}{3}$	34	$5\frac{5}{12}$	35	$3\frac{1}{2}$
$11\frac{1}{2}$	33	$11\frac{3}{4}$	34	$10\frac{3}{4}$	35	$9\frac{3}{4}$	36	$8\frac{5}{6}$	37	$7\frac{5}{6}$	38	$6\frac{7}{8}$
12	37	0	38	0	39	0	40	0	41	0	42	0
$12\frac{1}{2}$	40	$1\frac{3}{4}$	41	$2\frac{3}{4}$	42	$3\frac{3}{4}$	43	$4\frac{5}{6}$	44	$5\frac{5}{6}$	45	$6\frac{7}{8}$
13	43	$5\frac{1}{12}$	41	$7\frac{1}{6}$	45	$9\frac{1}{4}$	46	$11\frac{1}{3}$	48	$1\frac{5}{12}$	49	$3\frac{1}{2}$
$13\frac{1}{2}$	46	$9\frac{11}{12}$	48	$1\frac{1}{12}$	49	$4\frac{1}{4}$	50	$7\frac{1}{2}$	51	$10\frac{2}{3}$	53	$1\frac{7}{8}$
14	50	$4\frac{1}{3}$	51	$8\frac{2}{3}$	53	1	54	$5\frac{1}{3}$	55	$9\frac{2}{3}$	57	2
$14\frac{1}{2}$	54	$0\frac{1}{4}$	55	$5\frac{3}{4}$	56	$11\frac{1}{4}$	58	$4\frac{5}{6}$	59	$10\frac{1}{3}$	61	$3\frac{7}{8}$
15	57	$9\frac{3}{4}$	59	$4\frac{1}{2}$	60	$11\frac{1}{4}$	62	6	64	$0\frac{3}{4}$	65	$7\frac{1}{2}$
$15\frac{1}{2}$	61	$8\frac{3}{4}$	63	$4\frac{3}{4}$	65	$0\frac{3}{4}$	66	$8\frac{5}{6}$	68	$4\frac{5}{6}$	70	$0\frac{7}{8}$
16	65	$9\frac{1}{3}$	67	$6\frac{2}{3}$	69	4	71	$1\frac{1}{3}$	72	$10\frac{2}{3}$	74	8
$16\frac{1}{2}$	69	$11\frac{5}{12}$	71	$10\frac{1}{12}$	73	$8\frac{3}{4}$	75	$7\frac{1}{2}$	77	$6\frac{1}{6}$	79	$4\frac{7}{8}$
17	74	$3\frac{1}{12}$	66	$3\frac{1}{6}$	78	$3\frac{1}{4}$	80	$3\frac{1}{3}$	82	$3\frac{5}{12}$	84	$3\frac{1}{2}$
$17\frac{1}{2}$	78	$8\frac{1}{4}$	80	$9\frac{3}{4}$	82	$11\frac{1}{4}$	85	$0\frac{5}{6}$	87	$2\frac{1}{3}$	89	$3\frac{7}{8}$
18	83	3	85	6	87	9	90	0	92	3	94	6
$18\frac{1}{2}$	87	$11\frac{1}{4}$	90	$3\frac{3}{4}$	92	$8\frac{1}{4}$	95	$0\frac{5}{6}$	97	$5\frac{1}{3}$	99	$9\frac{7}{8}$
19	92	$9\frac{1}{12}$	95	$3\frac{1}{6}$	97	$9\frac{1}{4}$	100	$3\frac{1}{3}$	102	$9\frac{5}{12}$	105	$3\frac{1}{2}$
$19\frac{1}{2}$	97	$8\frac{5}{12}$	100	$4\frac{1}{12}$	102	$11\frac{3}{4}$	105	$7\frac{1}{2}$	108	$3\frac{1}{6}$	110	$10\frac{7}{8}$
20	102	$9\frac{1}{3}$	105	$6\frac{2}{3}$	108	4	111	$1\frac{1}{3}$	113	$10\frac{2}{3}$	116	8
$20\frac{1}{2}$	107	$11\frac{3}{4}$	110	$10\frac{3}{4}$	113	$9\frac{3}{4}$	116	$8\frac{5}{6}$	119	$7\frac{5}{6}$	122	$6\frac{7}{8}$
21	113	$3\frac{3}{4}$	116	$4\frac{1}{2}$	119	$5\frac{1}{4}$	122	6	125	$6\frac{3}{4}$	128	$7\frac{1}{2}$
$21\frac{1}{2}$	118	$9\frac{1}{4}$	121	$11\frac{3}{4}$	125	$2\frac{1}{4}$	128	$4\frac{5}{6}$	131	$7\frac{1}{3}$	134	$9\frac{7}{8}$
22	124	$4\frac{1}{3}$	127	$8\frac{2}{3}$	131	1	134	$5\frac{1}{3}$	137	$9\frac{2}{3}$	141	2
$22\frac{1}{2}$	130	$0\frac{5}{6}$	133	$7\frac{1}{12}$	137	$1\frac{1}{4}$	140	$7\frac{1}{2}$	144	$1\frac{2}{3}$	147	$7\frac{7}{8}$
23	135	$11\frac{1}{12}$	139	$7\frac{1}{6}$	143	$3\frac{1}{4}$	146	$1\frac{1}{3}$	150	$7\frac{5}{12}$	154	$3\frac{1}{2}$
$23\frac{1}{2}$	141	$10\frac{3}{4}$	145	$8\frac{3}{4}$	149	$6\frac{3}{4}$	153	$4\frac{5}{6}$	157	$2\frac{5}{6}$	161	$0\frac{7}{8}$
24	148	0	152	0	156	0	160	0	164	0	168	0

From 37 to 42 Feet long.—*continued.*

¼th of Girth.	37 Feet Long.		38 Feet Long.		39 Feet Long.		40 Feet Long.		41 Feet Long.		42 Feet Long.	
I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.	F.	I.
24½	154	2¾	158	4¾	162	6⅞	166	8⅝	170	10⅝	175	0⅝
25	160	7 1/12	164	11⅓	169	3¼	173	7⅓	177	11 5/12	182	3½
25½	167	0½	171	7 1/12	176	1⅛	180	7⅝	185	1⅝	189	7⅞
26	173	8⅓	178	4⅔	183	1	187	9⅓	192	5⅔	197	2
26½	180	5⅝	185	3⅝	190	2⅛	195	0⅝	199	11⅛	204	9⅝
27	187	3¾	192	4½	197	5¼	202	6	207	6¾	212	7½
27½	194	3¾	199	6¾	204	9¾	210	0⅝	215	3⅝	220	6⅝
28	201	5⅓	206	10⅔	212	4	217	9⅓	223	2⅔	228	8
28½	208	8 5/12	214	4 1/12	219	11¾	225	7⅜	231	3⅛	236	10⅞
29	216	1 1/12	221	11⅓	227	9⅝	233	7⅓	239	5 5/12	245	3½
29½	223	7⅞	229	7¾	235	8⅛	241	8⅝	247	9⅝	253	9⅝
30	231	3	237	6	243	9	350	0	256	3	262	6
30½	239	0¾	245	5¾	251	11⅝	358	4⅜	284	10⅛	271	3⅜
31	246	11 7/12	253	7⅛	260	3⅛	266	11⅛	273	7 5/12	280	3⅛
31½	254	11 5/12	261	10 1/12	268	8¾	275	7½	282	6⅛	289	4⅝
32	263	1⅓	270	2⅔	277	4	284	5⅓	291	6⅔	298	8
32½	271	4⅝	278	8⅞	286	0⅞	293	4⅝	300	8⅝	308	0⅝
33	279	9¾	287	4½	294	11¼	302	6	310	0¾	317	7½
33½	288	4¾	296	1¾	303	11¼	311	8⅝	319	5⅝	327	3⅝
34	297	0⅓	303	0⅔	313	1	321	1⅓	329	1⅔	337	2
34½	305	9 11/12	314	1 1/12	322	4¼	330	7⅜	338	10⅜	347	1⅜
35	314	9 1/12	323	3⅛	331	9¼	340	3⅓	348	9 5/12	357	3½
35½	323	9¾	332	6¾	341	3¾	350	0⅝	358	9⅝	367	6⅝
36	333	0	342	0	351	0	360	0	369	0	378	0
36½	342	3¾	351	6¾	360	9¾	370	0⅝	379	3⅝	388	6⅝
37	351	9 1/12	361	3⅛	370	9¼	380	3⅓	389	9 5/12	399	3⅜
37½	361	3 11/12	371	1 1/12	380	10¼	390	7⅜	400	4⅜	410	1⅜
38	371	0⅓	381	0⅔	391	1	401	1⅓	411	1⅔	421	2
38½	380	10⅞	391	1⅞	401	5⅛	411	8⅜	422	0⅜	432	3⅝
39	390	9¾	401	4½	411	11¼	422	6	433	0¾	443	7½
39½	400	10¾	411	8¾	422	6¾	433	4⅝	444	2⅝	455	0⅝
40	411	1⅓	422	2⅔	433	4	444	5⅓	455	6⅔	466	8

TABLE II.

Showing the Length of 1 Rood of Stone-dike, from 6 Inches to 10 Feet in Height.

Height of the Wall.	Length of One Rood.	Height of the Wall.	Length of One Rood.	Height of the Wall.	Length of One Rood.	Height of the Wall.	Length of One Rood.	Height of the Wall.	Length of One Rood.
F. I.	Y. F. I.	F. I.	Y. F. I.	F. I.	Y. F. I.	F. I.	Y. F. I.	F. I.	Y. F. I.
0 6	216 0 0	2 6	43 0 7	4 6	24 0 0	6 6	16 1 10	8 6	12 2 1
0 7	185 0 5	2 7	41 2 5	4 7	23 1 8	6 7	16 1 2	8 7	12 1 9
0 8	162 0 0	2 8	40 1 6	4 8	23 0 5	6 8	16 0 7	8 8	12 1 4
0 9	144 0 0	2 9	39 0 10	4 9	22 2 2	6 9	16 0 0	8 9	12 1 0
0 10	129 1 9	2 10	38 0 4	4 10	22 1 0	6 10	15 2 5	8 10	12 0 8
0 11	117 2 5	2 11	37 0 1	4 11	21 2 10	6 11	15 1 10	8 11	12 0 4
1 0	108 0 0	3 0	36 0 0	5 0	21 1 7	7 0	15 1 3	9 0	12 0 0
1 1	99 2 9	3 1	35 0 1	5 1	21 0 9	7 1	15 0 9	9 1	11 2 8
1 2	92 2 4	3 2	34 0 4	5 2	20 2 3	7 2	15 0 2	9 2	11 2 4
1 3	96 1 2	3 3	33 0 8	5 3	20 1 9	7 3	14 2 8	9 3	11 2 0
1 4	81 0 0	3 4	32 1 1	5 4	20 0 8	7 4	14 2 2	9 4	11 1 8
1 5	76 0 8	3 5	31 1 10	5 5	19 2 8	7 5	14 1 8	9 5	11 1 4
1 6	72 0 0	3 6	30 2 8	5 6	19 1 11	7 6	14 1 2	9 6	11 1 0
1 7	68 0 8	3 7	30 0 5	5 7	19 1 0	7 7	14 0 9	9 7	11 0 9
1 8	64 2 5	3 8	29 1 4	5 8	19 0 2	7 8	14 0 3	9 8	11 0 6
1 9	61 2 2	3 9	28 2 7	5 9	18 2 3	7 9	13 2 10	9 9	11 0 2
1 10	58 2 9	3 10	28 0 6	5 10	18 1 6	7 10	13 2 4	9 10	10 2 11
1 11	56 1 0	3 11	27 1 9	5 11	18 0 9	7 11	13 1 11	9 11	10 2 3
2 0	54 0 0	4 0	27 0 0	6 0	18 0 0	8 0	13 1 6	10 0	10 2 2

TABLE III.

Showing the Number of Trees that can be Planted on an Acre, whether the Scotch or the Imperial Acre, from 1 Foot to 25 Feet distance Plant from Plant.

Distance.	The Scotch Acre.		The Imperial Acre.	
	Plants of the Short 100 of 5 Score.	Plants of the Long 100 of 6 Score.	Plants of the Short 100 of 5 Score.	Plants of the Long 100 of 6 Score.
Feet.				
1	54760	45633	43560	36300
1½	24338	20318	19360	16133
2	13690	11408	10890	9075
2½	8761	7301	6969	5808
3	6084	5070	4840	4033
3½	4470	3725	3556	2963
4	3422	2852	2722	2268
4½	2704	2257	2151	1792
5	2190	1825	1742	1452
5½	1810	1508	1440	1200
6	1521	1257	1210	1008
6½	1296	1081	1031	852
7	1117	931	889	740
7½	973	811	774	620
8	855	713	680	567
8½	758	631	602	502
9	673	562	537	448
9½	606	505	482	402
10	547	456	435	363
11	452	375	360	300
12	380	317	302	252
13	324	270	257	214
14	279	232	222	185
15	243	202	193	161
16	214	178	170	141
17	189	158	150	125
18	169	141	134	112
19	151	126	120	100
20	137	114	108	
21	124	103	98	
22	113		90	
23	103		82	
24	93		75	
25	87		69	

EXPLANATION OF TABLE III

The preceding Table, from 1 to 3 feet, shews the number of Cabbages, Turnips, &c. that can be planted on an acre for feeding cattle.

From 1 to 6 feet—the number of young Timber or Forest Trees that can be planted on an acre.

From 6 to 20 feet—the number left after the first, second, and third cuttings.

From 20 to 25 feet—the number of Fruit Trees that can be planted on an acre.

By this Table may also be seen the difference or proportion between the Scotch acre and the Imperial acre. The first numbers in the second and fourth columns are the number of square feet in the Scotch and Imperial acres respectively; so the Imperial acre is to the Scotch acre as 43·560 is to 54·760, or as £ 1, in money, is to £1 : 5 : 1$\frac{7}{10}$. The proportions between the numbers of the second and fourth columns, and in the third and fifth columns, are the same throughout the Table: therefore, supposing the plants to be acres, and, exchanging the titles, putting Scotch in place of Imperial, and Imperial in place of Scotch, the corresponding numbers in the second and fourth columns, and in the third and fifth columns,

will be, the one the Imperial and the other the Scotch acres, corresponding to each other; thus, 54·760 Imperial acres make 43·560 Scotch, and 36·300 Scotch acres make 45·633 Imperial; but these numbers are not always exact, for the given distance will not produce an even number of trees without fractions, the expressing of which in the column of plants would not be proper; it is therefore omitted.

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FINIS.